CHEMICAL & METALLURGICAL ENGINEERING

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CHEMICAL & METALLURGICAL ENGINEERING

H. C. Parmelee
Editor

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Does the Army Need Chemistry?

PREPARATION of the federal budget for submission to Congress on Dec. 1 focuses attention on the financial support of the Chemical Warfare Service. At present the service is struggling along ineffectively under a budget of about $700,000 a year, supplemented by some support from the navy for the manufacture of masks and the investigation of certain chemical problems of particular naval interest. This support will diminish rather than increase, however, as fast as the navy's problems are solved and its needs supplied, so that all we can expect for chemical warfare must come from the regular army budget.

What the financial resources of the service will be under the new budget is not known, but unless there is a material increase over present funds, the development of the service will be retarded and important projects must languish for lack of support. Even defensive measures such as the manufacture of masks and the training of troops, with which the Chemical Warfare Service is charged and which are recognized as legitimate activities under the terms of the disarmament treaty, cannot be fully carried out. But the great and vital work of the service, that of functioning as the chemical research agency of the army, must be pitifully neglected unless increased appropriation is made. The organization is down to bed rock in both military and civilian personnel, without extravagant overhead but with an important plant to complete and keep in stand-by condition and with vital research problems calling for immediate attention. At present only a fraction of the latter can be undertaken.

The predicament of chemical warfare in the army is due to fundamental causes that must be frankly faced and publicly aired before adequate recognition will be obtained. The conservatism of the army and the apathy of public opinion, both supported by the resolution on chemical warfare at the recent conference on disarmament, conspire to put our Chemical Warfare Service in the background, though in *Chem. & Met.'s* judgment it will yet prove to be the Cinderella of our military establishment.

The treaty on disarmament has not yet been ratified by all the nations involved, and consequently is binding on none of them. In the meantime the United States is lagging behind the others in the study of chemical means of defense. The resolution on chemical warfare was not only idealistic in its conception but is now conceded to be futile in its effective execution. Research is going forward in England, Japan and other nations at a rate that will leave us far behind in the course of a few years unless we bestir ourselves. And in the face of these things we continue to live in a fool's paradise and devote to our own Chemical Warfare Service a sum less than that required for the maintenance of a regiment of soldiers.

This leads to a consideration of what is probably the fundamental obstacle to full recognition of the importance of our Chemical Warfare Service—namely, the conservatism of the army and the continuation of its present form of organization. Sooner or later the army must revise its estimate of the relative merits of the different arms of the service—infantry, artillery, cavalry, engineering, chemical, air, etc. Progress in the art inevitably overtakes military establishments just as it does civil organizations and necessitates a new evaluation of its various elements.

Chemical warfare is much more powerful now than it was in the World War; and even then the American killed and wounded by gas comprised more than 27 per cent of the total. The present appropriations for the army are probably $300,000,000 per annum, of which less than one-quarter of 1 per cent, or $700,000, is allotted to the Chemical Warfare Service. It would certainly seem as though there is something wrong in the evaluation of chemical warfare when it gets less than a quarter of 1 per cent of the entire army budget. The time would appear to be ripe, and more than ripe, for a re-evaluation of the arms of the service. That other modern arm, the Air Service, gets only $12,000,000 to $15,000,000 per annum, notwithstanding the fact that thoughtful students of future warfare believe that the Air Service and the Chemical Warfare Service will play the leading part. Are we not seriously endangering the national defense when the combined appropriations for these two arms comprise only 5 per cent of the army appropriation? Careful investigation must determine which of the older branches receives too large an allotment, because if the total appropriation cannot be increased some of the older branches of the service must get along with less money in order that the more modern arms may be properly supported. The issue must be squarely faced. *Chem. & Met.* expects to have more to say on this subject during the coming year.

One Hundred Years Of Public Service

VIEWED in terms of geologic ages or even of human history, one hundred years is such an insignificant period of time as to be almost negligible. But considered in the light of scientific and industrial development, the last one hundred years has witnessed practically all of the progress that has been made along these lines since the world began. Fortunate indeed is the Franklin Institute in its ability to look back over the whole of this momentous period and note with pardonable pride its own contributions.

So widespread is the fame of the Institute among many lands and in all branches of pure and applied

science that several hundred of the world's most eminent scientists, engineers and men of industry gathered in Philadelphia Sept. 17 to commemorate its one hundredth birthday.

Organized on Feb. 5, 1824, with four hundred members and James Ronaldson as president, the Institute's board of managers proceeded promptly to appoint committees on instruction, inventions, exhibitions, library, models and minerals. In the fall of the same year at Carpenters Hall it held an exhibition of American manufactures, a form of activity that has since been a prominent feature of its work. Annual exhibitions were held for more than a score of years, the Centennial Exposition in Philadelphia resulted from the efforts of one of its committees and in 1884 the Institute without federal or state aid held the first great electrical exposition in the United States, with 216 exhibitors and 282,779 paid admissions.

In 1826 the Institute moved into its present home and the same year marks the establishment of the *Journal* of the Franklin Institute, although this title was not used until 1828, when the Institute assumed entire management. It is interesting to note that prior to 1843 the United States Patent Office did not publish abstracts of specifications and claims and the *Journal* is the only source at present available for such information relating to patents issued between 1828 and 1843.

Evening courses of instruction and public lectures upon scientific subjects of very wide range have also characterized its educational program from the start.

In recent years much emphasis has been placed on the desirability of scientists and engineers—members of the Fifth Estate, as defined by Dr. Little—participating more actively in public affairs. The Franklin Institute stands as a splendd example of what can be accomplished by such a policy, consistently followed for a century.

Public Opinion And Foodstuff Waste

MOLDING current opinion so that the benefits of chemical control and the economy and efficiency of chemical engineering equipment get adequate recognition is a difficult task complicated by the unreasonable attitude of some manufacturers who think of their own commercial success first, of their industry last, and of the public weal not at all. However, this is not a matter relating to the apportioning of profit, but rather to the maintenance of the highest possible standards of purity at the lowest possible cost of production, the consummation of which is possible only by the application of unit process equipment and unhampered research. The public must be educated to realize that purity is the aim and object of processing in the food industries, and that the attainment and maintenance of such a standard should be the index of worth.

A recent experience prompts these comments: An article was prepared for publication that dealt with the manufacture of a food product susceptible of precise chemical analysis. The account proved to be extremely interesting, because the staff at the plant in question had developed a process whereby a waste product was being used; whereas competitors were using a raw product purchased at greater cost. Furthermore, the waste was a byproduct from the treatment of high-grade material, but the raw product used by competitors was of inferior grade. The new development was an excellent example of the frugal efficiency of chemical engineering methods in the utilization of byproducts. By actual analysis it was demonstrated beyond question that the waste material from the high-grade product gave an article of a better quality than the one obtainable from the whole product of inferior grade. The work being done was an object lesson on the benefits of technical research and the utilization of everything of value. It was a triumph of chemical engineering initiative.

We planned to pay adequate tribute to the enterprise of the manufacturer and to his success in the conservation of national resources; but on hearing this he put his foot down firmly. "Our competitors," he said, "would immediately make capital out of a statement that our product came from refuse; and no evidence as to greater purity and higher qualities would counteract the impression formed by the public." Such an attitude is detrimental to progress, and we make a plea for uncompromising frankness in such matters, believing that the public can be made to realize that adequate technical control and ultimate purity should be the primary factors governing the manufacture of foodstuffs.

Dedicated to the Average Executive

ONCE UPON a time there was a chemical engineer. All good fables begin in some such manner, even when they happen to be true, as this one is. There was nothing remarkable about this particular chemical engineer. He was honest, industrious, well trained and likable. Perhaps this combination is a little unusual, but let's not quibble about it. The head of the operating department—he was a vice-president or something—called him in one day and said: "Smith is having trouble with the bleephite plant. Go down to Plantdale and see what you can do to help him."

So our friend the chemical engineer went to Plantdale and reported to Superintendent Smith, who had apparently been advised of his impending arrival. Superintendent Smith was a good fellow in most ways, but he was a little annoyed that the V.-P. had sent somebody down to help him out when he didn't want to be helped out. This is what is known as an impasse in dramatic circles, but it wasn't the sort of thing that tended to speed up the solution of the technical problem. In fact, when the chemical engineer began to get to work he found a whole lot of little things cropping up to hinder him. The laboratory was crowded with work because of an investigation that Mr. Smith had under way. The pipe shop couldn't tackle his job for a while, there was a rush order in the alic acid plant that the superintendent wanted this week.

So the chemical engineer sat around and made friends with everyone. He even tried to make friends with Smith, but that was rather a difficult proposition, for Smith hadn't forgotten how the chemical engineer had come and what for. By and by the various foremen were glad to do the little jobs on the bleephite set-up and the head of the laboratory sneaked analyses through and the chemical engineer made progress because he was easy to like. He even made a report that was very favorably commended by the V.-P. and very thoroughly damned by Smith and Co., for they had to think up alibis (though they were handled with kid gloves in the report).

The report made such a hit that the V.-P. said he

thought it would be a good idea for the chemical engineer to stay at Plantdale and study the other processes. Smith said it was a good idea and cursed the chemical engineer to himself and his intimates. The chemical engineer said it was a good idea and his heart sank, but he needed the job, or thought he did.

And in due course of time, since he was not on special investigation and his reports went therefore to Mr. Smith instead of to the V.-P., the chemical engineer was seen by the V.-P. via Smith to be doing very little. "Good fellow and all that," Smith would say, "but seems to have lost his pep." As happens in the best-regulated corporations there came in due course a letter

". . . regret that curtailment makes this step necessary.

". . . salary for two months in advance.

Yours truly,

_____ _____

V.-P."

And the worst of it is that Smith and the chemical engineer might have been good friends and the chemical engineer could have been a great help to the organization if he had stayed. He might have been a V-P. or a superintendent. But it just wasn't staged right, and perhaps that is the moral of this tale.

Who Is This Hussey?

WHEN the anonymous author of "Nosaernu Lakimek" sent us his manuscript, which we subsequently published in our issue for Aug. 25, he said that the inspiration for his satire was found in an article on "The American Chemist," by L. M. Hussey, in the *American Mercury* for July. Curiosity led us to read Hussey's article, whereupon we concluded that satire was all too gentle a weapon with which to chastise him.

Who is this Hussey? In the tabloid biography on the author's page of the *American Mercury* he is described as "a Philadelphia chemist and pharmacologist of wide experience. He is a frequent contributor to the magazines." All this may be true, although Mr. Hussey is, we are advised, not a member of the American Chemical Society, which may be assumed to be the least common denominator of the chemical fraternity.

Mr. Hussey prefers to sit on a lofty eminence and condescend to the moribund American chemists. Verily a poor tribe, taking refuge in educational institutions, disregarded or rejected by industrialists! Here are a few examples of Mr. Hussey's pity and disrespect:

> The industrial chemist of the Continent is no such hang-dog fellow as his American brother. Nor is he in most cases so incompetent.
>
> . . . the deliberations of the Local Chapter [he is referring to a local section of the American Chemical Society] might well be mistaken for a singularly spiritless conclave of the State Haymakers, the Owls or the Junior Order of United American Mechanics.
>
> He is not a scientist at all; he is a mere technician, a workman.

Perhaps these three quotations will be sufficient to project the background and spirit of the article, a destructive spirit, a spirit of diatribe and vituperation. It would be in questionable taste even if there were not more serious defects with the article and with the author. We refer to the inaccuracy of the information that Mr. Hussey puts forth, with considerable literary skill to be sure, but with no regard for the first requisite of good journalism—honesty.

His article begins with a story of his failure to impress a manufacturer of compounded oils with the importance of chemical research. It is a well-told tale and leads him to the generalization that there "scarcely existed at all" in America employers possessed of sufficient culture to comprehend such men (as Baeyer) and such work. Of course the American employer needs no defense. The wide and ever-increasing use of the chemist and the chemical engineer by him is a complete controversion of the generalization. Hussey is either not familiar with modern developments or he prefers completely to disregard them in the interest of the "culture" that must come from a well-written satire.

Particularly flagrant is his arraignment of the Chemical Warfare Service. We publish the paragraph verbatim.

> Hundreds of such pathetic incompetents, with a natural disinclination for trench warfare, served during the late war of liberation in the Chemical Warfare Service, the most astounding goulash of chemists, savory and unsavory, ever assembled in one stew. I do not say that that Service, with its gargantuan personnel, its fabulous laboratories, its unparalleled confusion, its reduction of scientific research to the goose step, accomplished absolutely nothing. Far from it! I myself, in fact, was a witness to one accomplishment. It happened on an evening when I attended a local chapter of the American Chemical Society. An Arrhenius in olive drab, wearing spurs, lectured on the manufacture of poison gases. He passed around a bottle containing a milligram or so of mustard seed. The bottle was cunningly arranged so that one could get an innocuous whiff of the vapor. I took that whiff with a peculiarly luxurious, yes, Lucullan satisfaction. That single atom of poisonous stench probably cost the people of this great democracy no less than a millon dollars!

It is well written. That is its excuse for existence, but that one paragraph is a severe criticism of the editorial balance of the *American Mercury*. Merely because a man could write well, the editors have apparently lost sight of the fact that the substance may have been inaccurate. They have been spoofed. It is hardly necessary to defend the Chemical Warfare Service. We may jest about it, refer to it as Comical Welfare, but no man who was informed and honest would fail in appreciation of the well-directed and amazing work at the research headquarters in Washington. And Edgewood—a hay field in November, a gigantic chemical plant in August! Chlorpicrin was produced in May, phosgene in June, mustard gas in August (and the orders for this were received in May!). This does not mean a "milligram" as Mr. Hussey states; it means tons, and Mr. Hussey could have had some less innocuous whiffs of mustard gas if he had helped to develop the American method of production. By the way, what was it Hussey did in the war?

> Now, in the name of all the gods at once,
> Upon what meat doth this our Hussey feed,
> That he is grown so great? Research, thou'rt shamed!
> Chemistry, thou'st lost the breed of noble bloods!

A lengthy answer to Mr. Hussey is not in order. The steady fruitful march of American chemistry to the complete conquest of every industry that involves chemical change began long before this wise man of Philadelphia was swaddled, was continuing while he was failing to convince his employer of the merit of chemistry, and is still gathering momentum and power.

In the opening sentence of Mr. Hussey's article he refers to "the concluding years of my nonage." Vainglorious assumption. He is still in them.

Franklin Institute Centenary

International Leaders in Science, Engineering and Industry Pay Tribute to a Century of Service in the Interest of Science, Pure and Applied

Editorial Staff Report

IN HARMONY with the broad appreciation of science fostered by the Franklin Institute, those who gathered in Philadelphia Sept. 17 to 19 to commemorate the completion of its first century of unique service represented three groups: the universities, the learned and professional societies and industrial organizations. From each group more than 100 men of eminent position were asked to participate in the celebration. All parts of the world and all branches of science and engineering were represented on this memorable occasion.

On Wednesday morning the delegates formed in academic procession at the Hall of the Franklin Institute and proceeded to the Walnut Street Theater, where they were welcomed by Mayor W. Freeland Kendrick, of Philadelphia. Dr. William C. L. Eglin, president of the Institute, responded and then introduced Prof. Elihu Thomson, who reviewed the principal events of the past century in the fields covered by the Institute, particularly stressing electrical developments.

Technical features of the meeting included a lecture by Sir Ernest Rutherford Thursday evening, the addresses in connection with the opening of the Bartol Research Foundation and the sectional meetings, four of which were held each day. Abstracts of some of these are given below.

Thursday afternoon delegates and guests forsook the lecture halls to enjoy outdoor sports at a garden party on the beautiful grounds of the Philadelphia Country Club at Bala.

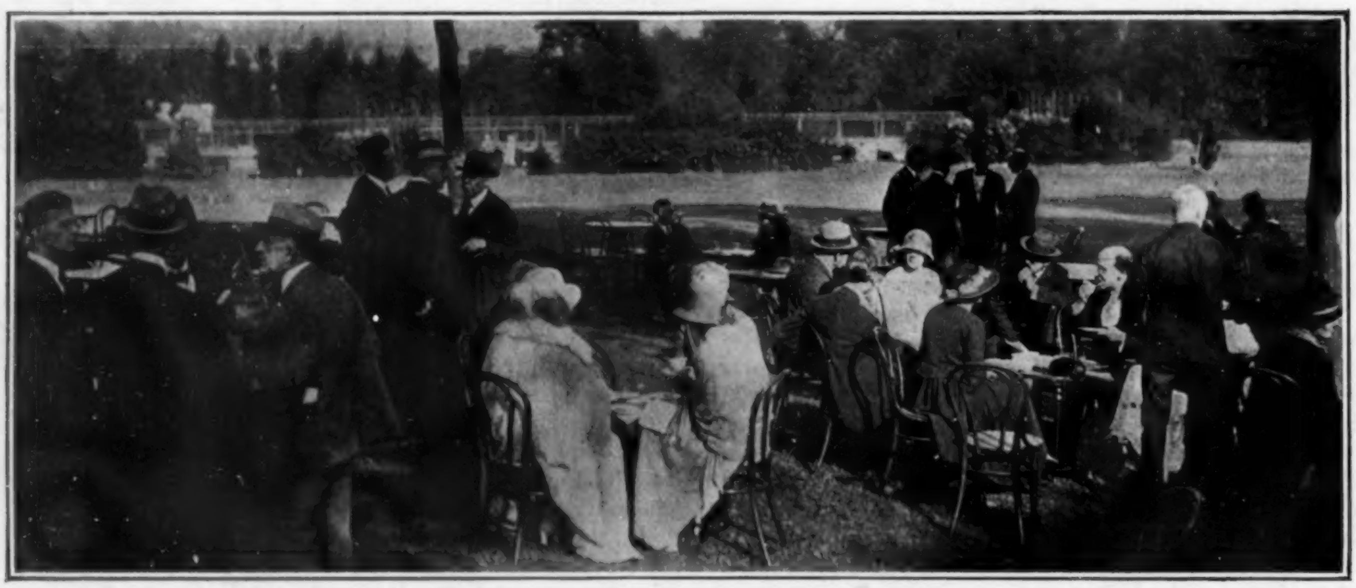
On Friday afternoon the honorary degree of Doctor of Science was conferred by the University of Pennsylvania upon Sir William Henry Bragg, head of the Royal Institution of Great Britain; Dr. William Charles Lawson Eglin, vice-president and chief engineer of the Philadelphia Electric Co. and president of the Franklin Institute; Dr. Charles Fabry, professor of physics, University of Paris; Sir Charles Algernon Parsons, chairman, Parsons Marine Steam Turbine Co., Ltd.; Dr. Edwin Wilbur Rice, Jr., honorary chairman of the board, General Electric Co.; Dr. Pieter Zeeman, rector magnificus and professor of physics, University of Amsterdam.

Prof. F. Haber, internationally known for his work on nitrogen fixation by ammonia synthesis, was one of the prominent speakers at the banquet which brought the ceremonies to a close Friday night. The substance of his remarks was as follows:

Dr. Haber's Address

"The history of a young country may be divided into three epochs. The first is the period of commerce. A sparse population gathers together the natural treasures of the soil and throws them as crude products upon the world market. They exchange these for the products which are the results of a higher development, which come from the hands of an older civilization. We see this state of affairs today in Spanish South America. This period was long past when I traveled in the United States 22 years ago.

"When the population becomes denser and finer qualities in needs and deeds become evident, we come to the period of technical development, in which the country takes over the processes from the people of older culture and applies them to its demands. Experience wanders from the Old World and naturally takes a new form, often more powerful and more impressive



Garden Party at Philadelphia Country Club, Bala

than under the closer and narrower surroundings of the country in which it originated. The United States was, 22 years ago, in this state of technical progress. It was astonishing what you had then accomplished, but you were destined to still greater performances.

"Today your nation appears to a visitor like one of the countries of an old culture. The first period of commerce lies far in the past; the second period of technical progress is also gone, and the third period, that of Science, has begun, in which the country is not dependent upon the Old World for either products or processes, but devises with its own creative genius the methods of work by whose aid it prepares its products.

"It is not now the congratulations of the wise teacher to the aspiring pupil that I extend. It is the respect of the older expert for the independence and splendid results accomplished by the younger colleague.

"This respect of mine brings to my tongue a few more words which are not addressed by a German to Americans, but by a naturalist to naturalists.

"In the last 20 years the world has undergone an immense upheaval. The lawyer, the soldier, the financier and the man of industry have emulated the striving after world supremacy and have overthrown the order of things. Now they are disputing with one another about reconstruction, and, for the ordinary looker-on, it seems as if in place of the reigning princes, who for centuries governed the world, we now have the controlling banker. But this is only a superficial aspect. The banker and lawyer, the industrialist and merchant, in spite of their leading positions in life, are only administrative officials, and the sovereign is Natural Science. Its progress determines the measure of the prosperity of man, its cultivation is the seed from which the welfare of future generations grows."

Atomic Disintegration

Before an audience that filled to overflowing the great auditorium of the University Museum, Thursday evening, Sir Ernest Rutherford told of some of his recent work in studying the structure of atoms.

In order to indicate the magnitude of the problem he said that if the entire population of the earth, 1,000,000,000, were to undertake the task of counting the atoms in 1 c.c. of air and were to count continuously at the rate of 3 per second, 10,000 years would elapse before they had finished. The problem is of course further complicated by the fact that when we do get to the individual atom we find it a most complicated system, with a positively charged nucleus of enormous density, surrounded by a solar system of negatively charged electrons. The nucleus itself seems to be built up to the fundamental electrical units, the positive proton and the negative electron. The elements differ simply by the amount of positive charge on the nucleus and this may be expressed by a series of whole numbers from 1 for hydrogen to 92 for uranium.

By bombarding the nuclei of various atoms with α-particles and photographing the tracks in a Wilson chamber, it has been found that there is a critical surface surrounding the nucleus inside of which the law of least squares fails to hold and there is instead an attractive force of unknown properties.

In order to effect atomic disintegration artificially it is necessary to bombard the nucleus with α-particles traveling at such a speed that they can penetrate this critical surface. This has now been done with the elements having atomic numbers 1 to 19 and in a number of cases the proton or the hydrogen nucleus has been identified as one of the products of the disintegration. The exceptions are H, He, Li, Be, C and O with atomic numbers 1, 2, 3, 4, 6 and 8 respectively. Above potassium the results were uncertain.

As to what remains in the nucleus when a proton is thus removed, Sir Ernest confessed that he did not know, although hundreds of thousands of photographs are being taken in the hope of obtaining a Wilson photograph that will show the result. The chance has been calculated at about 1 in 1,000,000.

Present at Opening Exercises
Seated, left to right: Prof. F. G. Donnan, University College, London; Mayor W. Freeland Kendrick, of Philadelphia; Dr. Leo H. Baekeland, president, American Chemical Society
Standing, left to right: Colonel J. S. Muckle; Prof. J. S. E. Townsend, Oxford University; Rear Admiral Scales, U. S. N.

Bartol Research Foundation

An impressive feature of the centenary was the unveiling of a tablet which marked the opening of the Bartol Research Foundation of the Franklin Institute. The tablet, in memory of Henry Welchman Bartol, who endowed the Foundation with $1,300,000, was unveiled by his grandniece, Miss Teresita Bartol Dalley, of Haverford. The Foundation, created specifically for research in fundamental problems of physical science, particularly electrical, and for investigating scientific problems in the industries, is housed temporarily in property owned by the Institute in 19th St., near the Parkway, a site that will be used later for a building to contain both the Institute and the Foundation.

C. C. Tutwiler, vice-president of the Institute, presiding at the ceremonies, stressed the fact that the facilities of the Foundation were to be at the disposal of scientific workers throughout the world.

Two addresses at the Academy of Natural Sciences, just across the street, completed the program.

The Fifth Estate

The first paper was by Dr. Arthur D. Little on "The Fifth Estate."

Benjamin Franklin may not have been a paragon, but he was most certainly a polygon—a plain figure, many-sided. He was at once philosopher and man of affairs, disproving the belief, prevalent then as now, that the scientist is unfit for the practical matters of life.

Franklin was in England when Burke referred to

the press as the Fourth Estate. But, as Dr. Little pointed out, Franklin himself was a prototype of a Fifth Estate, those trained in the scientific method, an estate destined to play a greater part than any of its predecessors in the development of human society. In spite of the fact that membership in this group is open to all, it numbers even today probably not more than 100,000 throughout the world. Vision, trained intellect and open-mindedness characterize the members of the Fifth Estate. They have the curiosity to wonder, the ability to question, the talent to generalize and the capacity to apply. They bring the power and the fruits of life to the multitude who are content to go through life without question, taking everything for granted.

It is interesting to note that while all are not gifted with trained intellects, all can enjoy the fruits of the scientists' and engineers' endeavors. That the Fifth Estate is not better appreciated is due largely to the almost impenetrable barrier of technical terms with which they have surrounded themselves.

The Franklin Institute

Science is made for life, but life is more than science, so that members of the Fifth Estate should try to emulate Franklin's devotion to public affairs. The practical man, busily engaged in repeating the errors of his grandfathers, has no time for such matters.

There has been a ready and general acceptance by the world of the material benefits of science, while its contributions to sociology and ethics are generally ignored as guides to human conduct. Yet science proclaims new commandments as inflexible as those engraved on stone, and furnishes what Wiggam has reverently termed "the true technology of the will of God."

Science has so drawn the world together and so rapidly remolded civilization that the social structure is strained at many points. We see in the ranks of science knowledge without power and in politics power without knowledge. The result is too often government by gullibility, propaganda, catchwords and slogans instead of government by law based on facts, principles, intelligence and good will. Human life is still a hard and fearsome thing; everywhere there is upheaval and unrest. One hundred years of science has failed to satisfy the cravings of humanity.

The world needs most a new tolerance, a new understanding, an appreciation of the knowledge now at hand. For these it can look nowhere with such confidence as to the members of the Fifth Estate. Theirs is the duty and the privilege of bringing home to every man the wonders, the significance and the underlying harmony of the world in which we live.

Stimulation of Research

Prof. D. S. Jacobus gave the concluding address, "Stimulation of Research and Invention." As a result of his experience on the boards of Engineering Foundation and of the National Research Council, his suggestions as to the functions of a research foundation are particularly significant.

The actual conducting of researches should be left to workers outside the Foundation, which should confine its efforts to the promotion of research by providing the means for assisting those doing the work. In general, the Foundation should: encourage research of a scientific character which gives promise of being generally useful; make no general restrictions regarding patents; require periodic reports, to be kept confidential and not to be published without the consent of the worker; grant no money for aimless researches but do not expect results from every investigation.

The question of patents is one of the most perplexing that arises in such work. A distinction should be made between patents on the specific topic of research and patents on byproducts. The worker should not benefit exclusively from patents on the problem to which he was assigned. Patents, when advisable for protecting the invention, should be taken out under an arrangement with the inventor. Patents on byproducts of the research should go to the inventor in his name.

Papers at the sectional meetings covered a wide range of scientific and engineering topics. About forty papers were presented before four sections, which met simultaneously on each of the three days. Several of these are given in abstract below.

Progress in High Explosives

Dr. Charles L. Reese, chemical director, E. I. duPont de Nemours & Co., presented a most interesting paper outlining the developments in high explosives during the past 25 years, particularly in America.

Black powder was dismissed rapidly, as there has been little change except in design of equipment. Continuous processes have been tried, but were found uneconomical.

Nitroglycerine production in 1923 amounted to about 100,000,000 lb. Yields have increased steadily through reduction of amounts lost in solution in waste acids and wash waters. Present yields are from 96.4 to 97.2 per cent of theoretical. Another saving has been effected by reducing the time for separating nitroglycerine from the waste acids. An emulsion due to the presence of colloidal silica retarded separation until it was found that this could be broken by the addition of sodium fluoride.

Important advances were made in the field of low-freezing and non-freezing dynamites. A low-freezing isomeride of nitroglycerine was discovered and later the addition of other materials to lower the freezing point was tried; nitrotoluenes, mixtures obtained by nitrating commercial solvent naphtha, TNT when this became cheap enough, and still later mixtures of nitrated sugar and TNT. About 1912 it was found that glycerine could be polymerized by heating at 230 to 250 deg. C. in the presence of 0.5 to 1.0 per cent sodium acetate under reduced pressures, 150 mm. Nitration of the polymer gave tetranitrodiglycerine, containing 16 per cent N as against 18 for nitroglycerine. This is very satisfactory for low-freezing dynamites.

For use in coal mines, explosives have been developed containing materials such as ammonium nitrate which absorb heat on decomposing and thus reduce the temperature of the explosion without seriously interfering with its effectiveness. Only these permissible explosives are allowed for use in mines where gaseous explosions may occur.

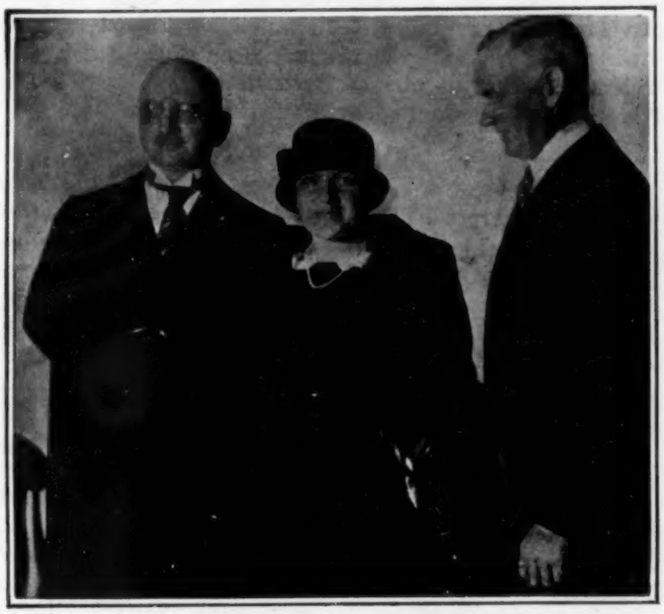
Provision against glycerine shortage has also received careful consideration. Ammonium nitrate coated with

petrolatum has been substituted for a part of the nitroglycerine, and glucose has been dissolved in glycerine before nitration. Commercial synthesis of glycerine from molasses awaits only the solution of some chemical engineering problems. Much work has been done on nitro-nitrates, aromatic compounds with NO_2 groups on the ring and in aliphatic side chains as well. All are liquid at ordinary temperatures; some colloid nitrocellulose with ease, others with difficulty.

Dr. Reese also referred to the important problem of salvaging surplus war explosives, particularly smokeless powder in large grain sizes. It was found that these could be reduced in attrition mills with a stream of water flowing through the mill and worked up into a commercial dynamite known as Pyrotol. The government has recently placed an order for 100,000,000 lb. of this explosive, the largest single contract ever made for high explosives.

Influence of J. Willard Gibbs

Prof. F. G. Donnan, University College, London, delivered a masterly address on the influence of J. Willard Gibbs on the science of physical chemistry. Professor Donnan paid enthusiastic tribute to Gibbs' work and



Dr. W. C. L. Eglin, President of the Franklin Institute (right), with Prof. F. Haber and Mrs. Haber

said that he ranked with men like Newton. Gibbs realized that the knowledge of atomic structure at his time was too limited to be of value, but built on the sounder foundation of energy and entropy.

Professor Donnan then traced step by step the development of Gibbs' fundamental equations and showed how they applied to almost every phase of physical chemistry. Just as Gibbs extended the earlier equations to cover changing conditions, there may some day come another who will develop generalizations that will apply to living, growing cells.

Progress and Promise of Engineering

Dean Dexter S. Kimball, College of Engineering, Cornell University, made a powerful plea for more general education along the lines of science so that the public might not only understand the ways of science but have faith in its applications. He cited the case of the Chicago Alderman who became greatly agitated over the fact that the two halves of a bascule bridge did not look as though they would meet when lowered. Much public discussion was aroused and quite general lack of confidence in the engineers was in evidence. Needless to say, the bridge closed perfectly, but even then the Alderman refused to admit that it was more than an accident.

Professor Kimball answered several criticisms that have been made against industrial civilization and pointed out that the scientific method was spreading to administration, to law and even to politics. Engineering developments in the past have been made with little regard to the possible effects upon the social structure. The automobile, for example, from the social point of view has its drawbacks as well as its advantages. More than science and more than engineering will be necessary if this civilization is to go forward, and Professor Kimball suggested that perhaps justice and the sense of shame might be two qualities that would help in correcting the weak points of the industrial system.

Technical Results of Theory

Prof. F. Haber, director, Institut für Physikalische Chemie und Elektrochemie, spoke Thursday before an enthusiastic audience on "Technical results of the Theoretical Development in Chemistry."

In explaining the relation between theoretical and technical work in chemistry, he divided modern chemistry into three important periods. In the first of these, organic chemistry was developed through application in the dye industry. Formulas were determined for a huge number of substances. This simple and non-physical picture was later supplemented by structural conceptions, the study of which occupied much of this period.

Thermodynamics next received attention and the whole field of physical chemistry began to develop. Professor Haber was quite frank in pointing out some of the limitations to application. In electrochemistry they had to be supplemented by practical investigations of design, electrode materials, etc. During this period, catalyzers played a most important part, and here again theory was of no avail in finding those catalyzers which would produce satisfactory results. At this point Professor Haber showed how thermodynamics had been of value in developing his well-known synthesis of ammonia, except in indicating the successful catalyst.

In the third and present period, atomic structure and capillary chemistry are the centers of interest. Looking forward, we may next expect that greater attention will be paid to investigations of natural processes and to the development of synthetic methods following more closely those used by plants and animals.

Among other addresses at the sectional meetings were the following:

Inorganic Crystals, by Prof. William L. Bragg; Carbon Atom in Crystalline Structure, by Sir William H. Bragg; Spectroscopy in Past and Present, by Prof. Charles Fabry; Radiating Atoms in Magnetic Fields, by Prof. Pieter Zeeman; Motion of Electrons in Gases, by Prof. John S. E. Townsend; Photo-elasticity, by Prof. E. G. Coker; Concentration and Polarization at the Cathode During Electrolysis of Solutions of Copper Salts, by Prof. W. Lash Miller; Theory of Color Production, by Prof. Julius Stieglitz; Development of Colloid Chemistry, by Prof. Wilder D. Bancroft; Appied and Scientific Photography, by Dr. C. E. K. Mees.

Economic and Technical Work of the League of Nations

Some of the Things Being Accomplished by It in Restoring the Economic Functioning of Europe

By E. J. Mehren
Vice-President, McGraw-Hill Co., Inc.

"THE League of Nations issue is dead." Such has been the pronouncement of a goodly number of American politicians. Some have even declared that the League itself is dead, or have interpreted America's abstention as an omen of early demise.

This week I spent 2 days in the Palais de Nations, the headquarters of the League in Geneva; and I can say with emphasis: "The League is not dead. Indeed, it is very much alive." It may not be fully competent yet to deal with crises of the magnitude that followed the assassination of the Austrian Archduke in 1914; it may never reach such competence, but it is a going organization, remarkably staffed for service between the nations and, following the treaty of Versailles, an absolutely necessary instrument for restoring the economic functioning of Europe.

This is not the place to speak of the political mission of the League, but there are economic and educational functions regarding which the engineer, the industrial leader, the man who wants to know what the world is doing, should be informed. It is these functions, and their commercial and economic effects, that will be discussed here.

Extrapolitical Activities

That the League should have such functions is obvious on a moment's reflection. The world today is a collection of producing units bound together by an elaborate network of commercial ties. Back and forth over the borders go the goods of one country in exchange for those of another, creating an economic dependence that, when disturbed, upsets the whole social organism. After the disruption, statesmen can throw down new boundaries almost at will, but the results will be chaotic until the experts in finance, communication and transportation readjust the services and mechanism that are cut asunder by the new lines.

An example will help to clarify this statement. Under the treaty, the determination of the sovereignty of Upper Silesia was left to a plebiscite. The results of the vote and its interpretation by the Council of the League were similar to what we should have if a north and south line were to be drawn just east of Pittsburgh as the boundary between two new nations. In Silesia the railroads were cut in most confusing fashion, mines in Poland had their shafts in Germany, railroad engine facilities were cut off from the lines served, the car supply was in a hopeless muddle.

The Communications and Transit Section of the League, consisting of engineers and railroad operators, was directed to straighten out the tangle. So well did it succeed that the economic life of Upper Silesia, though it is necessarily hampered, is proceeding at the present time in an orderly fashion.

Economic Functions

The economic and technical functions of the League are administered chiefly by the following sections:

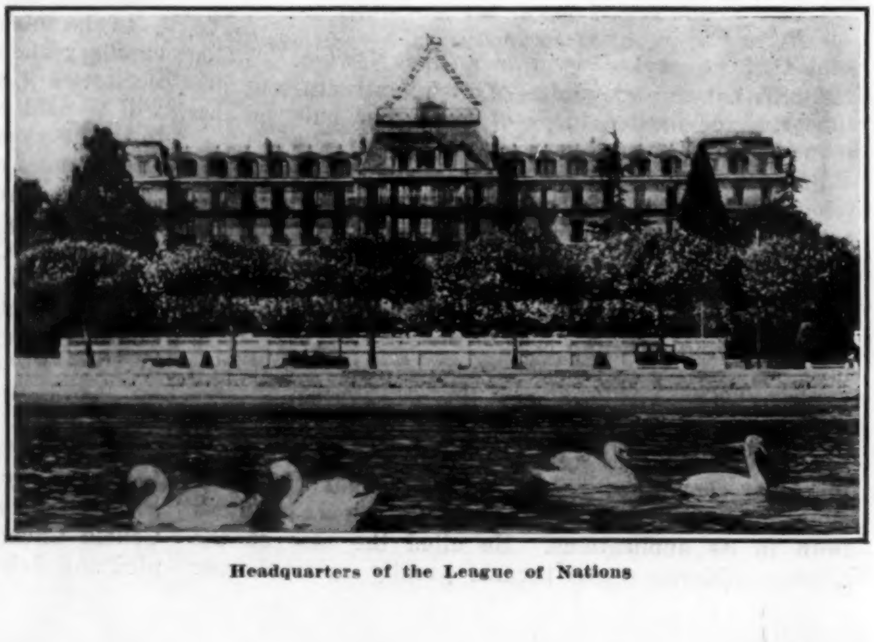
1. Financial and economic.
2. Transit.
3. Health.
4. Intellectual co-operation.

The International Labor Office, erected under the treaty, is an autonomous body and has its own organization, though its budget is subject to the control of the League. It works, of course, in harmony with the League and there is, where desirable, interchange of experts.

In the dramatic character of accomplishment the work of the Financial and Economic Section easily occupies first place. Austria came to the League a bankrupt and was put on its feet. Hungary is working under a somewhat similar rehabilitation plan, with Jeremiah Smith, Jr., of Boston, acting as commissioner-general of the League. A half million Greek refugees from Turkey are being settled on land under a plan, involving a large and difficult financing feature, worked out by this section. Danzig has been given a new currency, settling an almost impossible problem for this "free city," surrounded by Polish territory.

Transit Section

An example of the Transit Section's work has been given; it is typical of the special questions put before the section. There is, in addition, a long list of subjects involving day-to-day operation of means of communication on which the committee is working, all looking to the facilitation of transit between states. Much, of course, had been done in this direction by international conference and agreement before the war, such agreements as the Stresa convention on technical uniformity (standardization of gages, clearances, equipment, etc.), and the Bern convention covering international bills of lading. The section begins its work where such conventions leave off. The extension, for example, of the use of a through bill of lading and of standard contract provisions in the bill to shipments originating in, destined for or passing through all con-



Headquarters of the League of Nations

tinents as well as Europe is being sought by the League. Of course, in Russia and the United States the League has no government support—a bar to the world-wide extension of any uniform practice that may be adopted.

Of high interest, also, and of great international value, is the work of the Health Section. Its function can well be imagined by recalling the epidemics that have struck Europe since the war and realizing the need of dealing with them competently, if their spread was to be prevented.

Health Section's Important Work

It is natural, therefore, that the Health Section should have attacked the whole problem of public health administration and epidemic control in a very broad way. In addition, therefore, to most effective work in fighting epidemics in Russia, in the Russian border states and among the Greek refugees returning from Turkey—all of this in co-operation with the governments of these countries, and, in fact, largely as an adviser to and organizer of the country's own medical and sanitary forces—the section has become a vast information center on epidemic control and public health administration. Besides the typhus studies, inquiries have been made or are under way, among other subjects, into the causes of epidemics in the eastern Mediterranean, into sleeping sickness and tuberculosis in Africa, into the health problems (largely related to epidemic control) in Far Eastern ports, into cancer mortality and the indications of available cancer statistics, into methods of combating malaria, into port sanitation and into the production and standardization of serums.

An important feature of its work is the study, by international groups of physicians, sanitarians and public health officers, of public health administration in different countries. Groups have already been taken to Belgium, Italy, England, Austria and the United States (to the latter in the autumn of 1923). Special groups to study malarial control in Italy and to confer on bacteriological laboratory problems have also been brought together.

"Intellectual Co-operation"

The final extrapolitical phase of the League's work that has general interest is less tangible than those already described. It deals with "intellectual co-operation" and has as its purpose the development of contacts among thinkers and writers of all countries to the end that while "avoiding interference with the way each country expresses its own national genius" this will make it easier to draw upon the "common fund of knowledge, methods and discoveries."

International Labor Office

One other agency needs mention to complete the picture of the international economic and technical organizations centering at Geneva—namely, the International Labor Office. Its function is to gather information regarding labor conditions and, in conference, to develop out of this information recommendations and proposed laws. In the six conferences already held a variety of recommendations and measures have been adopted relating to such matters as hours of employment, night work by women, employment of minors, protection of workers in hazardous employment, employment at sea, use of white lead paint and collection of statistics regarding unemployment, emigration and immigration.

The theory of the office's work seems to be that workers are necessarily in international competition and that in fairness to them the conditions under which they work should be made uniform.

So far the results of the office's work have been the more effective in countries which are backward industrially and in labor legislation. It has borne an important part, through its recommendations and draft conventions, in the new Indian factory act, in new labor legislation in Japan and in the beginning of labor legislation in China. It is thus helping to bring conditions of labor in the more backward countries up to those which obtain in countries farther advanced, and thus to mitigate the competition to which the laborer of higher standards is subjected.

Government Backing

This, then, will show briefly that the League of Nations is not solely a political institution. It has technical, economic and educational functions of widespread influence. Whatever may be its strength as a political agency, it is a boon to the whole world, and to Europe in particular, for the extrapolitical work it is carrying on. It reminds one of the centralizing agency that is constituted by every national government, carrying on for the good of every section of its territory activities that necessarily transcend district borders. In Washington, for example, we have the Department of Commerce, the Public Health Service, the Bureau of Education and similar agencies. Geneva is likewise a centering ground of activities, of activities that transcend, not domestic, but international borders. Its influence is wide, for a map with the member countries marked in black shows white only at the United States and Mexico in the New World, and Germany and Russia in the Old.

Moreover, these extrapolitical activities of the League are much more effective than would be international co-operation by economists, technicians and educators without official standing. There was a great deal of such unofficial co-operation before the war, but much of it ineffective. The League's work all has official backing and its effectiveness is correspondingly great.

We, of the United States, of course, have no official connection with the League's work, but the extent to which Americans as individuals have participated is astonishing. Americans are represented in nearly nearly every important extrapolitical activity of the League and in many of the political ones. In all, 115 Americans have served on committees, have been present as "official observers" at conferences or have worked in the headquarters office at Geneva. As Dr. Manley D. Hudson, of Harvard, has said, "The United States is not in the League, but it is necessarily of it. The government has not become a member, but scores of Americans have joined."

As its activities expand, our interest in its extrapolitical as well as its political functions is bound to increase. As Basil Miles, of the International Chamber of Commerce, has well said: "We can keep out of European politics. We cannot keep out of European business." The League's activities will affect European business; they will, therefore, affect us. Accordingly American business men, industrialists, engineers, should know of the ramifications of this new international agency. It is to give them some idea of what it is and what it is doing, that this article is written.

Geneva, Aug. 8.

Carting Guayule to Shipping Point

Can America Rely on Latin America for Its Rubber Supply?

British Legislation, Combined With Economical Production in Far East, Makes New Sources of Supply Desirable for Our Manufacturers—The Possibilities of Cultivation in South and Central America Are in Many Respects Encouraging

By Otto Wilson
Former Chief, Latin-American Division, Department of Commerce

DURING the last year the possibility that para rubber might be cultivated in plantations in Brazil and elsewhere in Latin America as it is in the East has been made the subject of an extended investigation by the United States Department of Commerce. When the enormous volume of rubber from the cultivated trees in the Far East, mounting by great leaps year after year as new plantations added their quotas, finally overtook the growing demand, the downward swing of prices came closer and closer to the cost of production and threatened to pass it entirely, with serious results to the new industry.

The British Colonial Secretary appointed a committee to study the situation, and in May, 1922, this committee made its report. Its figures showed that production was much in excess of consumption and it recommended that an export tax on rubber should be laid in the British rubber-producing colonies and that production should be drastically curtailed and marketing so controlled that a minimum price of about 30 cents per pound should be maintained on the London market. (In 1910 para sold from $1.25 to $3 per pound.) These recommendations were put into effect in November, 1922, and prices soon began to rise sharply. This produced a strong reaction in the United States, which consumes three-fourths of the world's output, and Congress authorized Secretary Hoover to investigate the possibility of establishing the plantation industry in American territory and in the nearby lands of Latin America. With the active co-operation of American rubber manufacturers this investigation was undertaken. Commissions of experts were sent to the Far East, to Brazil, to Central America and to Mexico to study the possibilities of planting on a large scale. These inquiries have been concluded in most cases with the active co-operation of the South American governments, and the detailed reports of the commissions are to be issued soon.

Labor Problem Is Serious

One of the chief difficulties to be overcome is the wide difference in labor costs between the East and the West. The labor factor in cultivating rubber trees and in gathering and preparing the rubber from them represents a great part of the cost of operating a plantation. With the teeming population of the Indies, the British and Dutch colonies have an unending supply of very low-priced help. In contrast the rubber regions of Latin America are sparsely inhabited, and on the large plantations of other industries the established scale of wages is much higher than in the East. It has been suggested that Chinese and Japanese coolies might be imported into Central America and northern South America and one country, Panama, has recently removed restrictions against such immigration. However, there are many difficulties in the way of successful colonization and there is no present indication that it will be tried. Another obstacle is the natural reluctance

of American capitalists to invest in the politically unstable Latin-American countries the immense sums that would be necessary if any adequate competition with the East is to be set up.

Whether or not large-scale plantation enterprises can be carried out, rubber gathering from the wild trees can be made much less expensive than it has been. Brazilians have proposed to remove one of the handicaps by abolishing the export duties laid by the various states on rubber, which have brought in millions of dollars in the past, but this has not yet been done. Another suggested measure is to build up subsidiary industries alongside that of rubber gathering. If rubber gathering, which takes up only part of the year, could be woven in with other productive lines of work, its cost could be considerably cut. This naturally is a matter of many years development.

The countries of Latin America in which rubber trees grow wild include all those of northern South America, Brazil, Bolivia, Equador, Colombia, Venezuela, Peru and the Guianas; all of Central America; Mexico, and some of the West Indian islands. The number of Latin-American plants that produce latex is large, one authority listing 99 in Brazil alone. However, those that contribute to the world's supply of common elastic rubber belong chiefly to three or four species. These are the famous *Hevea brasiliensis*, which furnishes not only the para rubber of Brazil but most of the Far Eastern plantation rubber also; the *Castilloa elastica* and closely related species, found throughout Central

Tree of Hevea Braziliensis

America, in southern Mexico, the West Indies and the upper Amazon Valley; and the *Manihot glaziovii*, of northeastern Brazil, yielding the Ceara or manicoba rubber. The guayule of Mexico, although distinct in many ways from the product of these plants, is also to be classed as a rubber.

The heart of Latin-American rubber production is in the Amazon Valley, including all the region between the mouth of the river and the land sloping down from the Andes. The *Hevea brasiliensis* trees are found over most of this territory but only south of the Amazon River. The trees from which most of Brazil's rubber is obtained line the banks of tributary streams, and the uncertainty as to how far back they go makes it difficult to form an estimate of the potential rubber wealth of these regions. One estimate puts the number of rubber trees in the whole country at 300,000,000, but as a large part of the interior is unexplored, this is merely a guess. There are certainly millions of trees which the "seringueiros," or para rubber gatherers, have never touched.

The processes of gathering and coagulating the latex are primitive, but the product is often clean and fine, ranking as the best rubber produced in the world. The trees are tapped, on the average, about three times a week during the season, and the fluid is smoked and coagulated into balls or "biscuits" on the ground. The trees yield as much as 10 lb. of rubber yearly. The fluid not only looks like milk but contains little globules, like the butter-fat globules of milk, and if the latex is allowed to stand they will separate out and rise to the top like cream. These globules are the real rubber, making up about 32 per cent of the latex in the case of Hevea. They can also be removed by chemical treatment and by centrifugal machines.

Several Grades Produced by Different Cures

If the rubber is thoroughly smoked as it is built up, layer by layer, into large balls, and is free from impurities, it comes on the market as "fine hard para," commanding the top price. A slight distinction is made between "up-river" rubber and "island" rubber, the former being a harder cure than the latter, which is made on the islands of the Amazon estuary. If the latex has been badly smoked, it is classed as "entrefine" and brings a lower price. Then there are the "negroheads," made up of scraps coagulated on the trees or in the cups, and "virgin" or unsmoked rubber, marketed in whitish colored slabs. Fine hard para from Brazil usually contains about 15 per cent water, whereas plantation para has only about 1 per cent. Resin is a constituent of para rubbers, but the percentage is lower than for any other kind, that in washed wild rubber from the Amazon being 2.5 to 3.5 per cent and that from plantation para, according to Terry,[1] slightly less.

Bolivian rubber is carefully prepared, and because of this fact and its dryness it brings the top price on the market. It is sold under the same classification as para rubber, with which it is practically identical. Exports have reached more than 3,000 tons a year when prices were highest, but the decline in value has greatly affected the industry.

Central American rubber is entirely the product of Castilloa trees, of which there appear to be several species. One investigator names eight for Central America, besides two in South America. These species require different climatic conditions and yield varying amounts of rubber, and seedlings set out on plantations in other than their natural localities have proved, on occasion, to be failures. Uusually, however, the various species of Central America are lumped together and considered under the name *Castilloa elastica*, which was applied to these rubber trees by Cervantes in 1794.

[1]Terry, Hubert L., F.I.C. "India Rubber and Its Manufacture." New York: D. Van Nostrand Co.

The differences in yield of the various kinds of Castilloa are matched by differences in qualities of the product, and general statements regarding this class of rubber are usually to be made with qualifications. The trees often attain large size, as much as 180 ft. in height and 3 or 4 ft. in diameter near the ground. They were formerly credited with very heavy yields of rubber, but a fair average appears to be from a third or half a pound to 2 lb. annually for mature trees. The best yield seems to come from trees in regions where wet and dry seasons alternate. As the elevation increases the yield falls off and finally ceases entirely.[2] The milk does not flow very freely, but the rubber globules cream out easily and quickly and the work of coagulating the rubber and preparing it for market is thus simplified. Two or three processes are used. The latex may be diluted with water and allowed to stand, the resulting mass then being pressed into crêpe. Or infusions made from plants like the "moon vine" or the juice of the bindweed may be mixed into the latex, or the rubber globules may be removed by centrifugal machines. In Mexico the natives sometimes follow an ingenious method, spreading several successive layers of the liquid over a large leaf until a sheet about ¼ in. thick is formed, then pressing two of these sheets together and stripping away the leaves.

The rubber from Castilloa has a considerable range in quality, but the best is almost equal to fine para. The amount of resin contained in it varies not only with the age of the trees but with the part of the tree from which the latex is taken. Experiments with Central American Castilloas have shown that from trees 2 years old the resin content of the rubber was 42.33 per cent, scaling down to 7.21 per cent for 8-year old trees. The percentage of rubber in the latex is from 25 to 32.

[2]Cook, O. F., "The Culture of the Central American Rubber Tree," U. S. Bureau of Plant Industry, Bulletin 49.

Cross-section of Brazilian Caucho Rubber

Castilloa rubber has been rather extensively cultivated, chiefly in southern Mexico but also in some Central American states. In Mexico some of the plantations are large, but the yield per tree is small and the country's total output of Castilloa is of no great importance.[3] Castilloa cultivation has also been extended to the British West Indies, including Trinidad, Tobago and Jamaica. Neither these nor any other Castilloa plantations are now yielding large quantities of rubber.

By far the greater part of Mexico's rubber production in the past has come from a shrub which that country alone has exploited, the guayule. The product from this shrub contains about 20 per cent of resin, which, until the resin has been removed, makes it useless for the ordinary purposes for which commercial rubber is used. It has certain special uses, particularly in the manufacture of automobile tires, for which it is more suitable than any other rubber. The plant has received much attention from investigators in this country, as it grows within the United States as well as Mexico.[4] It is an inhabitant only of the Chihuahua desert in Mexico and its extension into Texas and New Mexico. It grows about 3 ft. high, its branches spreading out from just above the ground. It differs from nearly all other rubber-producing plants in that the rubber is contained not in a latex but within the structure of the plant cells themselves. It therefore cannot be obtained by tapping or cutting the trunk of the plant.

How Guayule Is Extracted

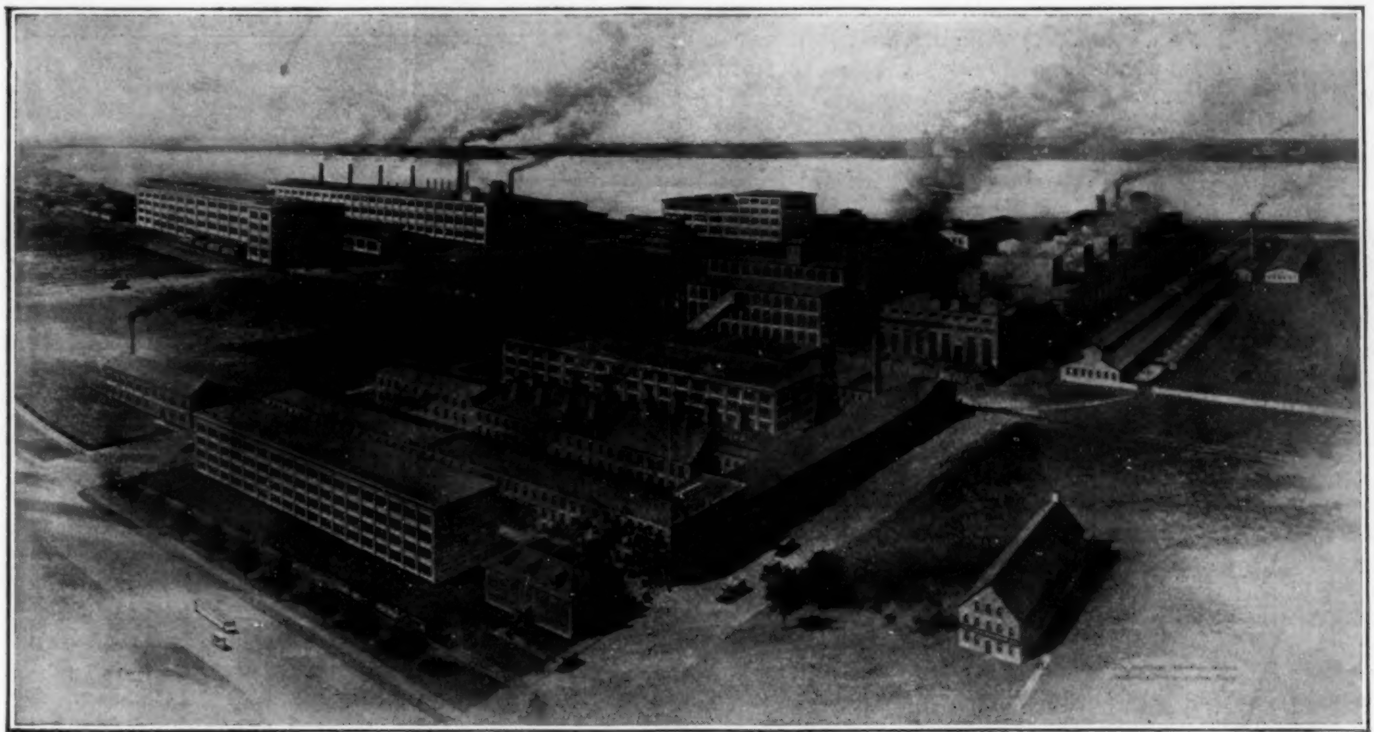
There are several methods of extracting it, one of which is as follows: The whole guayule plant, after being washed, is run through rollers fitted with knives or corrugated, at the same time being sprinkled with water. The result is a pulverized mass which is further reduced by grinding in a pebble-mill or a short steel cylinder containing flint shore-pebbles from Norway or the Mediterranean. This mill, containing water and guayule powder, is revolved at thirty times a minute for 1½ to 2 hours, when the mass within is a finely ground pulp. This is run into tanks, where the rubber floats on top of the water and can be easily skimmed off, while the woody particles for the most part sink. A further process cleans out the remaining non-rubber particles and the rubber is then washed and rolled into sheets.

The guayule industry a few years ago was one of some importance in Mexico, and exports of the rubber aggregated 4,000 or 5,000 tons annually. Production in recent years has been much less.

An important Latin-American product that resembles rubber in its source and properties but is not classified under the name is balata. It closely resembles gutta percha, with which for some time it was thought to be identical. It is produced from a tree which grows widely throughout tropical regions, but its chief commercial source is Venezuela, the Guianas and the West Indian islands Trinidad and Jamaica. The Amazon regions of Brazil are also said to have many balata trees, and that country in recent years has been exporting several tons annually under the name "massaranduba."

[3]It has been reported that a plantation of Hevea trees had been set out in southern Mexico and agents of the U. S. Department of Commerce planned to investigate, but were unable to do so because of the disturbed conditions in that region.

[4]The Carnegie Institution of Washington has published an exhaustive study of guayule, by Prof. Francis E. Lloyd.



Niagara Falls Plant—The Carborundum Company

Manufacturing an Artificial Abrasive

Some Observations on the Technology of Carborundum Manufacture — The Processes Involved Required Ingenious Engineering to Make Large-Scale Production Possible

THERE is an old song that comes to mind irresistibly and might be paraphrased to read:

"Old Carborundum ain't what he used to be
Thirty-five years ago."

Certainly the picture of a chemical inventor carrying a few grains of a new chemical product in his vest pocket and selling them to a prominent New York jeweler for several dollars a carat is a far cry from the huge industry of today. Between the two is a story of pioneering in technology that required the most ingenious engineering skill.

Most operating men are familiar with the fundamental facts of carborundum. They know that it is an electric furnace product, that it is silicon carbide produced by the interaction of coke with sand at high temperatures. Few of the details of manufacture have been made public, however.

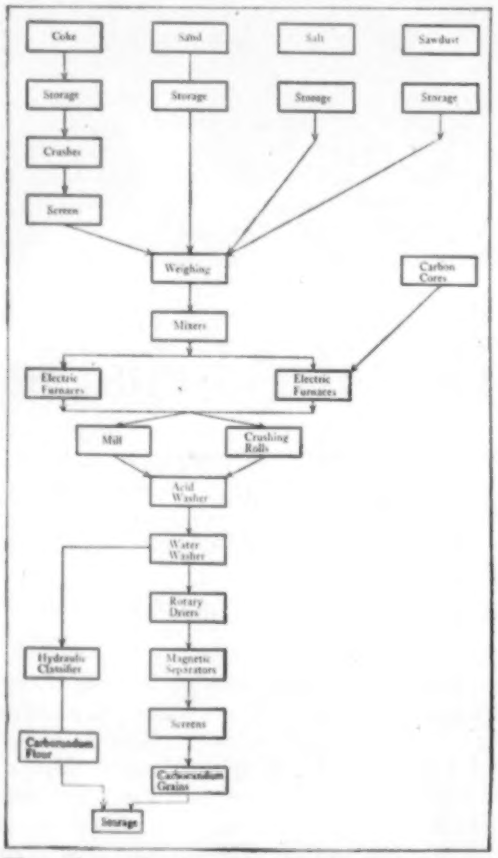
In this article and the one to follow some interesting features of design and operation of equipment are presented through the courtesy of the Carborundum Company. In order to simplify the description, a flow sheet accompanies this article and on this the steps of the process may be traced. Carborundum or silicon carbide is produced from coke, sand, salt and sawdust. These materials are weighed automatically, mixed together and transported to electric resistance furnaces. Here a chemical reaction takes place at a high temperature and silicon carbide is produced. The carborundum crystal masses are separated from the amorphous material and unreduced charge, are crushed, purified and sized through screens. The finished product at this point consists of twenty-one different sizes of grains. These are the raw materials for abrasive wheels, which will be discussed in another article.

The construction of the electric furnace is unique. It consists of a U-shaped trough of firebrick 6 ft. across, 6 ft. deep and 40 ft. long. The brick are supported on piers in such a way that the furnace bottom is kept cool by air circulation. At either end of the trough is a reinforced pier through which water-cooled electrodes are run. In making up the charge the mixed raw materials are loaded into the trough until the level of the electrodes is reached. A core of graphite, the current carrier, is run through from one electrode to the other. The remainder of the charge is then heaped over the graphite core, and when completed consists of about 70,000 lb. of material in the form of a cylinder.

There is no noticeable change after the current is turned on. Gradually the charge shrinks in volume and flames of carbon monoxide appear, flickering over the surface of the charge as well as between the loosely set firebrick of the walls and bottom. The coke and sand are, of course, the actual raw materials for the product (silicon carbide), the sawdust being introduced simply to make the mass porous and to allow the ac-

cumulating gases to escape, while the salt will react with any iron and aluminum oxides present to form volatile chlorides.

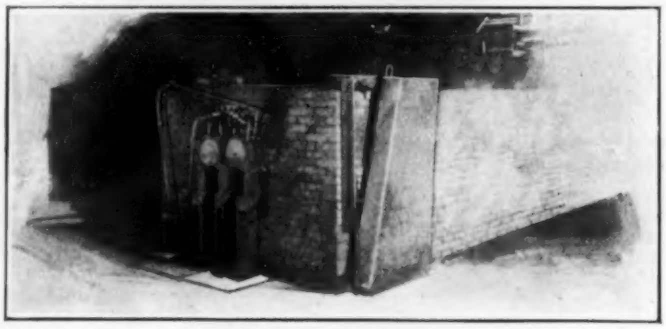
There is an important lesson in heat conservation to be learned from carborundum furnace operation. To look at a furnace is to be impressed with the great quantity of gases burning over the surface of the charge. "What a tremendous waste!" is the first thought, and the second is, of course, "What a great saving if it could be utilized!" But the truth is that the heat from the burning gas is utilized. The reaction between carbon and silicon dioxide can take place only between certain temperature limits and practically the flow of electrically produced heat away from the center or reaction zone must be prevented. There



Flow Sheet Showing Steps in the Manufacture of Carborundum

are two ways in which this may be accomplished. The most obvious would be the insulating of the outside of the furnace with material that is a poor conductor of heat. This would diminish the rate of flow of heat, though the temperature drop would be the same. The other method would be to raise the temperature of the surface and thus diminish the temperature drop and therefore the rate of flow.

The latter is the method of conservation in the carborundum furnace. Carbon monoxide, one of the reaction products, is burned on the outside of the furnace, thereby decreasing the temperature gradient and effectively preventing the flow of high-temperature heat from the reaction zone. Still another advantage of this method is that by utilizing the heat of combustion of carbon monoxide an equivalent quantity of electrical energy is conserved. Careful calculations show that if the carbon monoxide were collected from insulated furnaces and utilized as a fuel in an orthodox way, the costly collecting apparatus and additional electric power



Carborundum Furnace
End view, showing reinforced brick pier through which water-cooled electrodes pass

required would make the present method more economical.

The mass after the completion of the run is composed of several concentric strata or rings. On top is a loose crust composed of siliceous material and unconverted charge. This is returned to the mixing room, or when badly caked with impurities from the hot zones is thrown out. Next comes a layer of partly converted mix and poorly crystallized carborundum. This is known as "firesand" and is utilized as a low-grade refractory for rammed linings, etc. Inside of this, and gradually merging into it, is the high-grade carborundum of abrasive quality. After being allowed to cool, the masses of intercrystallized carborundum grains are broken up with bars into pieces that a man can lift, and are transported to the crushers.

The furnaces operate on 1,500 to 2,000 kw. in producing 10,000 to 16,000 lb. in a run of 36 hours. The average power required is about 3 kw.-hr. per lb. of carborundum. The whole furnace room is equipped to handle about 14,000 hp. A group of four furnaces makes up a unit, and one of them is always being heated. This means that a furnace is heated for 36 hours, cooled for 36 or 48 hours and then unloaded and reloaded so as to pick up the current 108 hours after it was started on the previous run.

The crushing problem is also unique to the industry. It must be carried out so that twenty-one sizes of grains will result, and so that the naturally sharp edges will be retained. The cutting ability of the abrasive depends much on these edges.

Aside from these two factors, the wear on the equip-

Close View of a Mass of Fused Carborundum Crystals

ment itself is a tremendous problem. It was necessary to construct a mill in which the crushing would be done by the carborundum itself. The mills are horizontally rotating pans about 7 ft. in diameter. On each pan rest two heavy wheels (about 4 ft. in diameter and 1 ft. thick) that rotate as the pan turns under them, the carborundum being brought beneath the wheels by means of baffles. Each wheel weighs about a ton and has a tire of chilled iron in order better to withstand abrasion. Even the chilled iron tires are worn badly into rough corrugations resembling a shallow irregular gear.

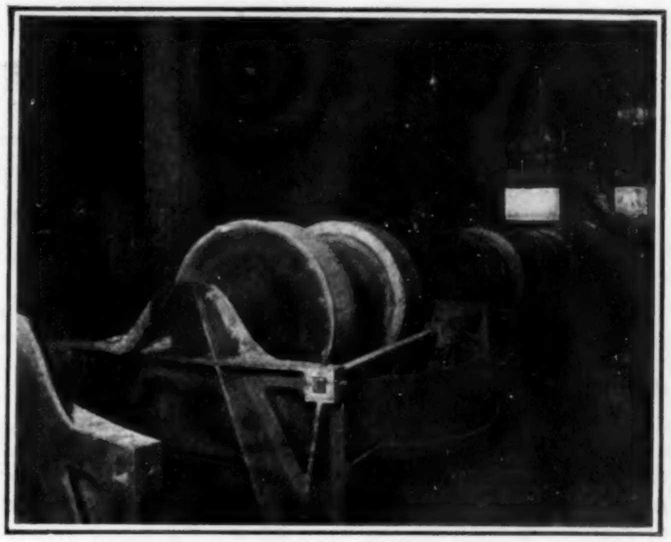
It can easily be seen that a continuous operation system is almost out of the question because of the problem of grinding to different sizes. The present mills each handle a 700- to 800-lb. batch and accomplish the work in about an hour. As might be expected, the pans last longer than the wheels, but even they do not stand up for a full year.

Two impurities must be removed before carborundum can be made into abrasive wheels. The first impurity is acid-soluble material, which has a deleterious effect on the ceramic bonds used in making abrasive wheels. The second impurity is graphite.

Carborundum Furnace
Side view after the completion of a run, showing masses of carborundum crystals freed from unchanged charge and fire sand

The crushed material is first put through an acid digestion in lead-lined tanks, after which the acid is removed in a counter-current system in which a screw conveyor pushes the material up an inclined trough against a down-coming stream of water. This was no mean technical problem in itself. Carborundum would, of course, play havoc with the average conveyor flight, and therefore a sturdy conveyor made of heavy cast iron but of the usual type is used. The finer particles carried away in the washings are collected in settling tanks and after some further purification are classified and constitute the fine abrasives of commerce.

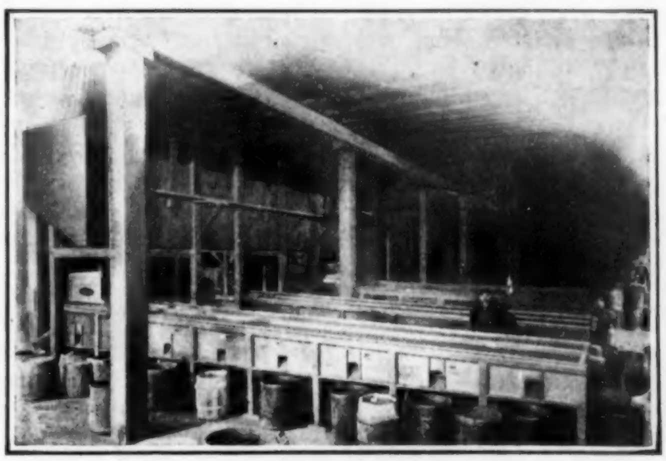
The bulk of material goes from the troughs to a battery of home-made rotary driers, each about 3 ft. in diameter and 20 ft. long, with a capacity of roughly 3,000 lb. per hour. The removal of iron impurities, introduced after the acid treatment by abrasion of containers, takes place some time between this point and the end of the grading operation, by means of a magnetized roll over which a belt carrying the carborundum



Grinding Mills for Breaking Up the Crystal Aggregate—Note the Corrugations on the Surface

is run, although Dings high-intensity magnetic separators are used in certain cases.

A brief consideration of abrasives will indicate the necessity of uniformity of size. Workmen using abrasives count on them as reliable tools from which definite results can be expected. Therefore the grading must be accurate. A first separation is made on a 50-mesh screen, the two parts then being separately graded. The type of screen is in each case the same, the only difference being in the mesh of the cloths used. A frame 18 in. wide and about 30 ft. long is divided into ten sections 3 ft. long, over each of which screening wire or cloth is stretched, each section having larger screen openings than the one immediately preceding. This frame is inclined somewhat and is operated with an ordinary cam shaft producing 300 reciprocations a minute. Carborundum is fed in through a special device and passes over the screens of increasing mesh. On all except large sizes, silk bolting is used, because the openings are more uniform and do not clog so readily. For some trades, particularly where wheels for precision grinding are used and also for those using abrasive paper and cloth, it is necessary to re-sift the material on a check screen that has larger sifting area and smaller capacity than the long screens. A second article will discuss the manufacture of abrasive wheels from these graded grains.



Classifying Screens

The New Aluminum-Silicon Alloys

An Important Process of "Modification" and the Remarkable Improvement in Properties It Brings About

By Junius D. Edwards and Robert S. Archer
Aluminum Company of America

THE PAST 3 years has seen a remarkable development of the aluminum-silicon alloys. Silicon, which formerly was generally regarded as a more or less objectionable impurity in aluminum, is now recognized as a valuable alloying element. The alloys of aluminum with silicon were known for many years, but their practical advantages had not been realized.

Although there are a number of reasons for the present importance of these alloys, the recent interest in them arose very largely from the work of Aladar Pacz.[1] Pacz found that a remarkable improvement could be brought about in the properties of certain aluminum-silicon alloys by treatment of the molten alloys with a flux containing sodium fluoride.

The nature of the change brought about by this treatment is at first glance quite puzzling and has been a fascinating subject for study. It is the object of this article to present some experimental results and a theory of the mechanism of the process developed some years ago by the research staff of the Aluminum Company of America. This theory has been touched upon in previous patents[2] and publications,[3] but no complete and connected account has heretofore been published. In the development of the composite picture here presented, Dr. Zay Jeffries has collaborated fully.

> The "modification" of silicon-aluminum alloys consists of treating the molten metal with metallic sodium or a flux containing sodium fluoride, and results in an alloy of greatly increased strength and resistance to shock. These alloys are at present widely employed in the automotive field. Their application to other industries is rapidly increasing.

This discussion will refer to the binary alloys of aluminum with silicon. In the commercial alloys there is always an appreciable quantity of iron, and for convenience we shall assume that the iron content of the alloys discussed is 0.5 per cent.

An alloy containing 13 per cent silicon, when melted in the usual manner and cast into test bars in green sand, will give a tensile strength of approximately 20,000 lb. per sq.in. with an elongation of about 3 per cent. These properties refer to a test bar with unmachined surface ½ in. in diameter with a gage length of 2 in. The same alloy when treated in a suitable manner with sodium fluoride before casting will give on the average about 27,500 lb. per sq.in. tensile strength with 7.5 per cent elongation.

The fracture of the alloy when cast without any special treatment, and therefore in what we may call a normal condition, is relatively coarse, crystalline and gray in color. The gray color indicates that fracture has taken place largely through the gray silicon constituent. After treatment with the sodium fluoride flux, the fracture is very fine grained and rather fibrous in appearance. It is also much whiter in color, indicating that the surfaces exposed are largely those of aluminum rather than of silicon. The alloy is then said to be in the modified as distinguished from the normal condition.

It is not to be understood that there is an absolutely sharp distinction between the normal condition and the modified condition. The extent or degree of modification varies continuously from the coarse normal structure to the fully modified structure just described. A specimen may show a mixture of structures.

If the modified alloy is remelted and cast without any further treatment, it will be found to have reverted largely to the normal condition. Repeated remelting or prolonged exposure in the molten condition causes a complete reversion to the normal state.

The system aluminum-silicon has been regarded by previous workers as a simple eutectiferous one without the formation of compounds of aluminum and silicon. The eutectic composition and temperature have been previously given. Frænkel,[4] in 1908, published the first diagram of the aluminum-silicon alloys and reported the eutectic alloy to contain about 10.5 per cent silicon and to have a eutectic freezing temperature of about 576 deg. C. Roberts,[5] in 1914, confirmed these figures and put the eutectic composition at 10 per cent silicon and the eutectic temperature at about 578 deg. C. More recently the eutectic composition has been stated by Guillet[6] to be 13.8 per cent silicon and the eutectic temperature 570 deg. C. Rassow[7] finds the eutectic composition to be 13.8 per cent. It should be noted, however, that Rassow reached this conclusion solely by the examination of the microstructure of thirteen alloys containing from 12.53 to 13.71 per cent silicon. Wetzel and Konarsky[8] put the eutectic composition at 12 per cent silicon.

One of us has recently[9] given the equilibrium diagram of the aluminum-silicon alloys based on our own experimental data. The eutectic composition is placed at approximately 11.6 per cent silicon and the eutectic temperature at 577 deg. C. In locating the eutectic composition, main reliance was placed on the initial

[1] U. S. Pat. 1,387,900, Aug. 16, 1921.

[2] Edwards, Frary and Churchill, U. S. Pat. 1,410,461, March 21, 1921.

[3] Jeffries, *Chem. & Met.*, vol. 26, p. 750, 1922, and vol. 28, p. 392, 1923; Edwards, *Chem. & Met.*, vol. 27, p. 654, 1922, and vol. 28, p. 165, 1923.

[4] Fraenkel, *Z. anorg. Chem.*, vol. 58, p. 154, 1908.

[5] Roberts, *J. Chem. Soc.*, Lodon, vol. 105, p. 1383, 1914.

[6] Guillet, *Rev. Met.*, vol. 19, p. 303, 1922.

[7] Rassow, *Z. Metallkunde*, vol. 15, p. 106, 1923.

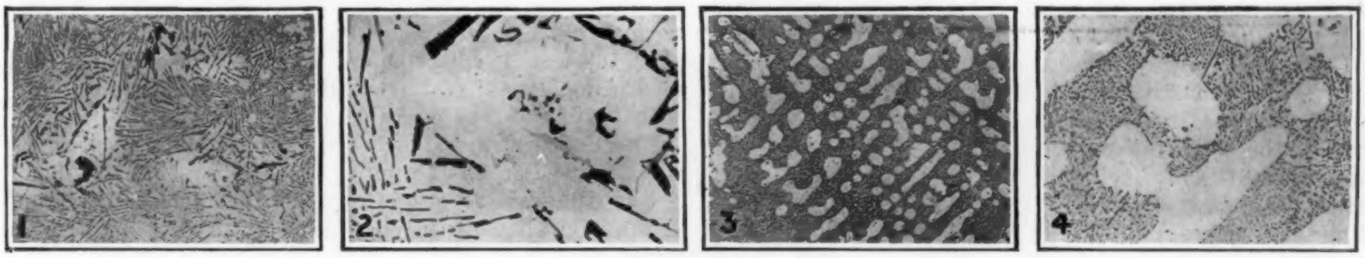
[8] Wetzel and Konarsky, "Metallbörse," p. 2704, 1922. Reference taken from article by Rassow[7].

[9] Edwards, *Chem. & Met.*, vol. 28, p. 165, 1923.

freezing points of alloys containing aluminum in excess of the eutectic composition, since, as will be noted later, alloys containing silicon in excess of the eutectic composition show pronounced tendencies to undercooling, and hence give very erratic results.

The microstructure of the 13 per cent silicon alloy in the normal and modified conditions is shown in Figs. 1 to 4 inclusive. In the normal alloy there appear: (1) Excess silicon in the form of fairly equiaxed particles or plates; (2) eutectic silicon in the form of plates or needles, and (3) a white background or matrix of aluminum, which we know to contain a small but from the present standpoint unimportant amount of silicon in solid solution. In other words, the structure of the alloy consists of a coarse-grained aluminum-silicon eutectic containing a small excess of silicon. The alloy is hyper-eutectic.

In the modified alloy we find at low magnifications a white constituent in dendritic form and dark area filling the space between the white dendrites. At higher magnifications we find that this dark area is duplex in structure, consisting of more or less rounded purple particles in a white matrix, as shown in Figs. 4 and 6.



Figs. 1 to 4

Fig. 1—Normal aluminum-silicon alloy containing approximately 13 per cent silicon. × 55. Fig. 2—Same as Fig. 1 but × 280. Fig. 3—Modified aluminum silicon alloys. × 55. Fig. 4—Same as Fig. 3 but × 280.

The white constituent of the modified alloy has the appearance of substantially pure aluminum, and its dendritic manner of occurrence is characteristic of primary crystallization. The alloy, however, contains an excess of silicon over the eutectic composition and we should expect the primary crystallization to be free silicon instead of aluminum. The finely divided constituent in the interdendritic areas has an appearance similar to that of the larger plates of silicon in the normal alloy, but we are not justified in assuming that it is identical with this silicon without some further evidence.

It was early suggested that the modification process might consist in a change in the nature of the silicon, allotropic or otherwise. This suggestion received some support from the fact that it is common in chemical analysis to report silicon as either combined or graphitoidal. Without going further into the possibilities, it is sufficient to say that the silicon of the modified alloy was definitely identified with that of the normal alloy by means of the X-ray spectrometer. The X-ray spectrograph (powder method) of the normal alloy shows the pattern which is characteristic of free silicon superimposed upon that of aluminum. An identical pattern is obtained from the modified alloy, showing that the silicon is present in the same crystalline form.

We may, therefore, conclude that the modified alloy containing 13 per cent silicon consists of dendrites of aluminum in a matrix that is a mixture of finely divided silicon with aluminum. The alloy in the modified form also shows the characteristics of a hypo-eutectic alloy.

The change brought about by the sodium fluoride treatment, or "modification," thus involves a marked decrease in size and a rounding of the silicon particles as well as an apparent shifting of the eutectic composition.

Further light is thrown on the modification process by thermal analysis. Fig. 5*A* shows a cooling curve of an alloy containing approximately 13 per cent silicon after treating with the sodium fluoride flux in such a manner as to produce the improved physical properties and characteristic structure of the modified alloy. This is a direct time-temperature curve taken on about 2 lb. of metal with a Leeds & Northrup potentiometer recorder. It can be seen that there is a little primary separation. From the structure of the solidified alloy, which shows aluminum dendrites, we may conclude that this first break in the cooling curve is due to the freezing of primary aluminum. The bulk of the alloy solidifies at a constant temperature of 570 deg. C.

In Fig. 5*B* is shown a heating curve of the same sample used for Fig. 5*A*. It will be noted that the melting point of the eutectic is higher than the freezing point shown in Fig. 5*A*, the actual temperature being 577 deg. C. The melting of the excess aluminum is clearly indicated.

After taking the heating curve shown in Fig. 5*B*, the alloy was held in the molten condition for about 15 hours, after which another cooling curve, shown in Fig. 5*C*, was taken. The freezing point of the eutectic is now identical with the melting point as shown in Fig. 5*B*.

These curves show that the freezing point of the aluminum-silicon eutectic is depressed by the modifying treatment. We have also found that in hyper-eutectic alloys the temperature of separation of the excess sili-

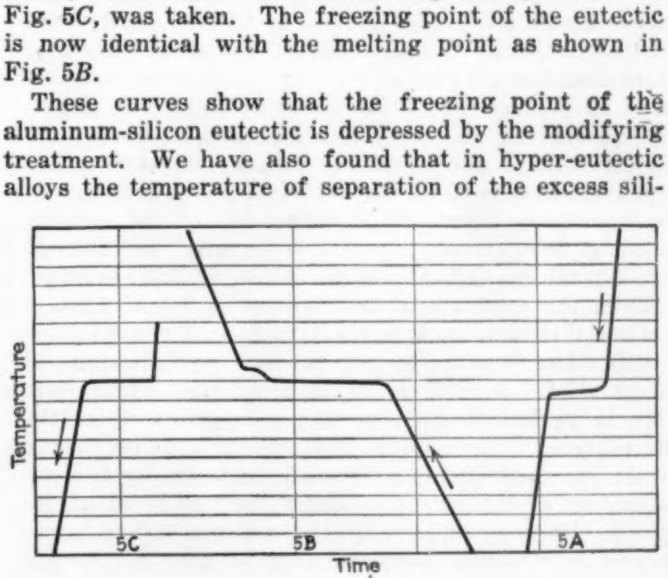


Fig. 5

Time-temperature, cooling and heating curves of 13 per cent aluminum-silicon alloy: *A*, cooling curve of modified alloy; *B*, heating curve of modified alloy; *C*, cooling curve of normal alloy, obtained after holding molten alloy at high temperature.

con is likewise depressed, whereas in hypo-eutectic alloys the temperature of separation of the excess aluminum is not as a rule perceptibly altered. These points are illustrated in Figs. 7 and 8. Curve *A* (Fig. 7) is taken with an aluminum-silicon alloy containing 14.5 per cent silicon and represents the cooling characteristic of the normal alloy plotted in the form of an inverse rate curve. The initial separation of excess silicon is shown by the first cusp in the curve, which occurs at 610 deg. C. The eutectic itself freezes at 577 deg. C. Curve *B* was taken with the same alloy and under the same conditions except that a modifying treatment was used. The initial crystallization no longer occurs at about 610 deg. C, but starts at a substantially lower temperature, and it can be seen from the area between the curve and the neutral axis of cooling that considerably less silicon is solidifying than in the alloy represented by Curve *A*. Furthermore, the eutectic temperature itself is depressed, in this case about 1.5 deg. C. After solidification was complete, the alloy was remelted and another series of observations taken, as shown in Curve *C*; this is substantially similar to Curve *B*. Again the alloy was remelted and Curve *D* was taken in exactly the same manner. Apparently the modifying agent had begun to be eliminated through the repeated remelting because the initial freezing after reaching a minimum has again become more pronounced even though still repressed; the eutectic temperature has returned to approximately the normal value. Experience has shown that the extent to which the eutectic freezing point is depressed depends upon the rate of cooling and the amount of modifying agent present. Some observations showed the eutectic freezing point depressed as much as 12 deg. C.

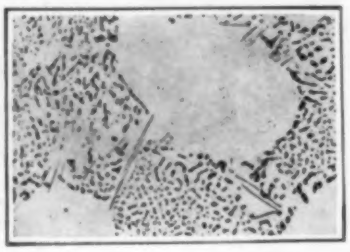


Fig. 6
Same as Fig. 4, but × 540, showing extremely fine dispersion of silicon particles.

These curves represent an alloy containing silicon in excess of the eutectic composition. In Fig. 8 is shown a series of curves taken with an alloy containing excess aluminum. This particular alloy contained 9.6 per cent silicon. Curve *A* shows the normal freezing characteristics of the alloy. Curve *B* represents the same alloy after modifying treatment, and Curve *C* is a third freezing curve of the same alloy after remelting. It will be noted that the initial separation of excess aluminum is in no way affected by the presence of the modifying agent. The depression of the eutectic freezing temperature occurs, however, just as was noted in the case of the alloys containing excess silicon.

From the evidence of the cooling curves of Figs. 7 and 8 the conclusion is obvious that, as a result of the modification treatment, the normal crystallization of excess silicon is entirely or in great part suppressed. This is evidenced both by the disappearance of the sharp break in the cooling curve which is characteristic of the commencement of freezing and also by the undercooling of the eutectic. Thus the failure of excess silicon either to appear in the microstructure or to appear in amounts corresponding to the equilibrium diagram is readily corroborated by the thermal data. The fine-grained structure characteristic of the modified alloy is in part explained by the fact that the normal formation of silicon nuclei and their growth is held back until temperatures much lower than normal are reached. The repressed force of crystallization proceeds from many centers and with great rapidity, resulting in a kind of "shower formation," which gives to the silicon particles an extremely high dispersion.

It should be noted that we do not, as has been erroneously stated in a number of foreign publications, claim that there are two eutectics in the aluminum-silicon alloy system, one corresponding to the normal alloy and one corresponding to the modified alloy. There is only one true eutectic, which corresponds to equilibrium conditions in the normal alloy. However, there is a metastable condition produced by undercooling in the presence of the modifying agent which allows a higher concentration of silicon to be reached in the molten alloy by the time it solidifies as an undercooled eutectic. A further fact supporting this view is that, although the apparent freezing point of the eutectic may be greatly lowered, due to the presence of the modifying agent, nevertheless the melting point of the eutectic, even in a modified alloy, always occurs at the normal eutectic temperature. This clearly indicates that the condition produced by the presence of the modifying agent is a metastable one and does not correspond to the true equilibrium.

There was at first much uncertainty as to just what was involved in the action of the sodium fluoride flux. Sodium fluoride is a good solvent for both silica and alumina and it seemed possible that its refining action might be due in part to removal of these oxides from the metal with perhaps a more complete solution of the silicon. These possibilities were greatly reduced by the discovery of the research staff of the Aluminum Company of America, described in full in the patent above mentioned,[10] that the aluminum-silicon alloys can be modified by the addition of metallic sodium or potassium. In the light of this discovery and with the experience gained in the modification of these alloys with metallic sodium, it is easy to recognize that metallic sodium is produced by the action of sodium fluoride on molten aluminum. From this it becomes obvious that other compounds can be used as modifying agents providing they are capable of producing metallic sodium or potassium under the conditions of use.

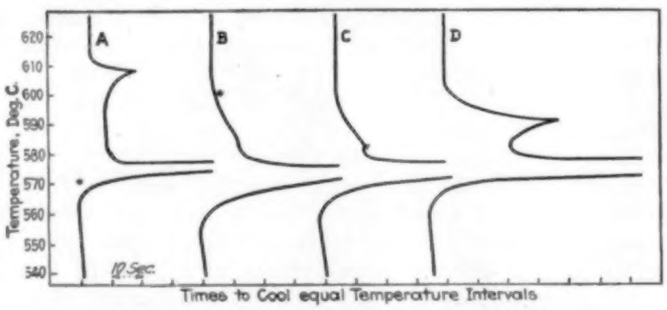


Fig. 7
Inverse-rate cooling curves of aluminum-silicon alloy containing 14.6 per cent silicon: *A*, before modification; *B*, after modification; *C* and *D*, after first and second remelting of modified alloy.

We shall now proceed directly to the theory of the mechanism of the modification process which we consider to be correct. Subsequently we shall consider briefly two theories that have been proposed elsewhere and that in the light of all the information available we believe to be untenable.

The suppression of the development of crystalline

[10] Edwards, Frary and Churchill, U. S. Pat. 1,410,461, March 21, 1921.

silicon may be referred to either or both of two causes: (1) The destruction of crystalline nuclei, and (2) an increased obstruction to crystal growth.

The supposition that the phenomena described are due to an extensive destruction of silicon nuclei is easily disposed of. To test this supposition we have heated aluminum-silicon alloys to extremely high temperatures in order to destroy nuclei, afterward cooling them at various rates, sometimes with considerable rapidity, to a normal pouring temperature. This treatment in general produces a more completely normal structure rather than a tendency toward the modified structure. Perhaps the most conclusive argument against this view is the fact that a batch of molten alloy that has been treated in such a way as to produce on casting a completely modified structure will, if allowed to stand in the molten state at a temperature well above the freezing point, gradually revert to a normal condition. This takes place while standing at temperatures at which silicon nuclei cannot form.

The modification phenomena present characteristics which are typical of certain grain growth phenomena encountered in solid metals.[11] The action of a material that obstructs grain growth is not entirely simple. It might at first appear that the obstructing effect of a given material present in the form of particles of a given size and shape would increase continuously with the quantity of the obstructing material present and that consequently the grain size of the various crystalline constituents affected would continuously decrease as the amount of obstructing material increased. It is found, however, that in many cases the first addition of an obstructing material causes little if any reduction in grain size, that a certain further addition of this material causes a tremendous increase in grain size

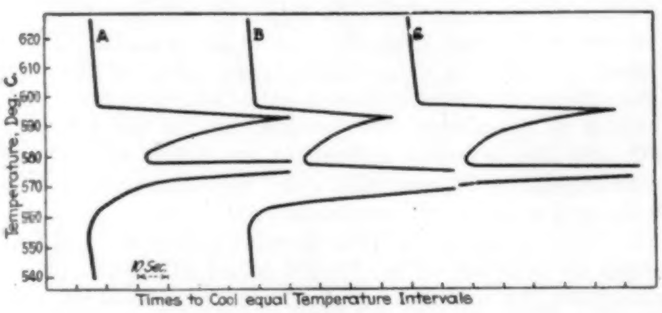


Fig. 8
Inverse-rate cooling curves of aluminum-silicon alloy containing 9.6 per cent silicon: *A*, before modification; *B*, after modification; *C*, after remelting modified alloy.

and that still further additions cause a refinement of grain. The extremely coarse grains are formed under conditions which are described as "germinative." It is not to be supposed that the resistance to grain growth follows these same phases. It is quite probable that the resistance to grain growth does increase continuously with the amount of obstructing material added. The germinative condition is thought to result when there is a marked difference between the resistance to growth of very small grains and of very large grains.

The conditions have been very fully worked out in the case of thoria and tungsten. The thoria is present in the form of very small highly dispersed globules which mechanically obstruct the growth of the tungsten grains. At a certain critical percentage of thoria germinative conditions are obtained so that extremely large grains are formed.[12]

In the modification of aluminum-silicon alloys it appears that obstruction to grain growth in the liquid alloy is introduced in amounts that cause a marked refinement of the silicon constituent. At the same time, however, the aluminum constituent is quite coarse. In fact, it appears that the amount of obstruction which is required to cause refinement of the silicon particles at the same time produces germinative conditions in the aluminum. We have found, for example, that a modification treatment which properly refines aluminum-silicon alloys causes marked increase of grain size in an aluminum alloy containing 4 per cent copper.

This is quite readily understood in view of the fact that aluminum, like other metals, crystallizes very readily, whereas silicon is a metalloid of less simple crystal structure and consequently has a less powerful tendency to rapid crystal growth.

Metallic Sodium Obstructs Crystal Growth

The demonstration that the modification process is due essentially to metallic sodium shows that it is very probably the metallic sodium that is the obstructing material. Sodium is only slightly soluble, even in liquid aluminum, and according to our observations its solubility decreases rapidly with falling temperature; it is practically insoluble in solid aluminum. If metallic sodium is stirred into the molten aluminum-silicon alloy at, say, 750 deg. C., then a certain amount is dissolved corresponding to the solubility relations at that temperature, and probably some is mechanically dispersed by stirring into the alloy. As the alloy cools, the small amount of metallic sodium that is dissolved in the liquid is precipitated, due to the reduction of solubility on cooling, forming an infinite number of very fine particles which during at least some period of their life are of colloidal size. These particles of insoluble sodium suspended in the liquid act as an obstruction to the growth of the crystal grains and interfere with the migration of the silicon and aluminum atoms that must necessarily occur before they can attach themselves to the pre-existing nuclei. This sluggish movement of the atoms corresponds exactly to the observed undercooling of the alloy, and such undercooling in turn is known to promote fine-grained structures growing from many centers.

Observation indicates that when the aluminum-silicon alloys are treated with the alkali fluorides, alkali metal is produced by the reduction of the compound by the aluminum. This alkali metal then can function in the same way as the metallic sodium just discussed. Formation of metallic sodium in the alloy by reduction in situ may possibly assist in increasing its dispersion in the alloy. In addition, there is a possibility that other inorganic products of the reduction reaction may assist in the modifying action by offering mechanical obstruction to crystal growth just as postulated for the minute particles of metallic sodium.

There is another way in which the sodium can interfere with crystal growth other than by the mechanism of mechanical interference of discrete particles which has just been described. According to this other viewpoint, the crystallization of silicon is suppressed by adsorption of the alkali metal. Through solution and precipitation, or through mere stirring, a colloidal dis-

[11] "Grain Growth and Recrystallization in Metals," by Zay Jeffries and R. S. Archer, *Chem. & Met.*, vol. 26, p. 449, 1922; *Chem. & Met.*, vol. 26, p. 402, 1922; *Chem. & Met.*, vol. 26, p. 343, 1922.

[12] See footnote 11.

persion of alkali metal is formed in the alloy. As the molten alloy of aluminum and silicon cools, crystal nuclei of the silicon begin to appear; these nuclei are in a state of kinetic equilibrium with the liquid and form and dissolve, but become increasingly stable as the thermal agitation decreases with falling temperature. Simultaneously, with the formation of the silicon nuclei, sodium is separating as a highly dispersed phase, and this sodium is preferentially adsorbed by the silicon nuclei and inhibits their growth. The normally slow rate of crystallization of silicon, relative to that of aluminum, is thus made even slower by the protective film of adsorbed sodium on the silicon nuclei. This promotes the undercooling of the eutectic because of the absence of characteristic nuclei and results in the shower formation of the eutectic when it finally crystallizes. That the adsorption affinity of silicon for sodium may be greater than that of aluminum is evidenced by the almost complete immiscibility of sodium and aluminum at temperatures near the melting point.

According to this conception of the adsorption process, the silicon nuclei or crystallites are not necessarily completely covered with adsorbed sodium. The adsorption film is in equilibrium with the liquid, and may be considered as evaporating and condensing on the surface of the crystallite continuously. Such a silicon crystal can still grow, but at a greatly reduced rate, because only a fraction of its surface is in appropriate condition for the condensation of silicon atoms. It is also not essential that every silicon nucleus be protected even in part by adsorbed sodium. From this general viewpoint, the function of the alkali metal is that of a protective colloid.

Ternary Eutectic Unlikely

A suggestion has been advanced that the sodium alloys with the aluminum and silicon and changes the equilibrium by forming a ternary eutectic. This can hardly be possible in view of the very minute quantity of sodium, probably less than 0.02 per cent, that is required to modify the alloys. The depression of the freezing point of the eutectic cannot be due to the formation of a ternary eutectic, since if this were so, the melting point should also be depressed. This is not the case, the melting point of the modified eutectic being identical with that of the normal eutectic.

One of the first explanations advanced was that sodium fluoride when used as a modifying agent removes by its fluxing action particles of silica and alumina and hence by a cleansing or refining of the alloy produces a casting of markedly improved physical properties. This explanation did not attempt, however, to account for the changes in microstructure observed. Furthermore, when it is considered that a flux is not essential but that similar results can be obtained by metallic sodium, this explanation appears entirely inadequate. An additional argument, if one is needed, is that the modifying action is lost if the alloy is allowed to stand in the molten condition, although this treatment should be beneficial from a cleansing standpoint.

It may be concluded, therefore, from our explanation of the phenomenon that obstruction to crystallization in liquid alloys is not peculiar to aluminum-silicon alloys alone. It is highly probable that alloys of other metals will be found whose structure can be advantageously controlled by the introduction of a grain-refining material into the liquid alloy. A large and profitable field of investigation is thus revealed.

The authors are indebted to E. H. Dix, Jr., metallurgist of the Aluminum Company of America, for preparing the exceptionally fine photomicrographs used to illustrate this article.

Canada's Liquid Fuel Problem

Discussing the liquid fuel problem in Canada before the Chemistry Section of the British Association for the Advancement of Science, recently gathered in Toronto, Dr. G. S. Hulme brought out many important facts bearing on the present situation.

The production of oil in 1923 in Canada was obtained from wells in New Brunswick, Ontario and Alberta, but was only 1.3 per cent of the total consumption of crude and refined oils for the same time, representing an adverse trade balance of nearly 31½ million dollars. Such a condition has greatly stimulated boring operations within the last few years, and tests of prospective fields have been made in many places, the most promising results being obtained in Alberta. However, even though a certain increase in production is possible from wells, the consumption is so far in excess of production that the probability of making Canada independent of foreign oil supply in the near future from this source alone are not very great.

Canada, however, possesses immense potential resources of oil in the tar sands of Alberta and the oil shales of the Maritime Provinces. The tar sands of Alberta occur over an area of 7,500 to 8,000 square miles, some portions of which give 20 per cent bitumen carrying an oil content as high as 69 per cent. The oil shales of New Brunswick and Nova Scotia will in places produce as much as 30 to 36 imperial gallons of oil to the ton with some byproducts, and the amount of oil shales available is exceedingly large. For neither of these deposits, though, has a satisfactory commercial process of extraction been evolved up to the present, although the technical difficulties are being studied by experimental work and laboratory investigation, and it is hoped a solution will be discovered.

In Nova Scotia in 1915 the Dominion Iron & Steel Co. began the recovery of benzol and toluol with other products from the coking of coal. These were used during the war for the manufacture of explosives, but subsequently have been combined as a motor fuel, the production of which reached 292,000 gal. in 1921. It is claimed that this motor fuel possesses qualities which make it superior to the best gasoline, and with the establishment of coke ovens elsewhere in Canada, such as are now under consideration, motor fuel from this source will become increasingly important.

Chemistry of High Temperatures

Under the above title there was published in our Aug. 18, 1924, issue, p. 262, a report by Dr. Richard Amberg of a meeting of the Bunsen Society. For the information of readers who are anxious to obtain further information on this subject we desire to call their attention to the fact that nearly all of the papers referred to have since been published in *Zeitschrift für Elektrochemie,* published by Verlag Chemie, Bosestrasse 2, Leipzig.

Equipment News

From Maker and User

Filter Plate of Great Strength

A porous plate of great strength is now being made by the Norton Co., Worcester, Mass., to meet the needs of the chemical, metallurgical, electrochemical and sewage treatment fields. These plates are made of electrically fused alumina grains bonded together in the kiln with an aluminous glass. The resulting ware is practically unaffected by acid, neutral and slightly alkaline liquors. It is dissolved by strong and hot sodium and potassium hydroxides and by hydrofluoric acid and is therefore not recommended for their filtration. The solubility of the material is shown by the following table:

Solution	Strength in Per Cent	1 Day	Cumulative Loss—Alternating Hot and Cold		
			10 Days	20 Days	30 Days
		85–100°C	75 hr. at 85–100°C 169 hr. at 20°C	131 hr. at 85–100°C 349 hr. at 20°C	192 hr. at 85–100°C 528 hr. at 20°C
Phosphoric acid	85.00	.340	.373	.522	.654
Phosphoric acid	42.50	.267	.290	.362	.394
Sulphuric acid	96.00	.198	.326	.444	.488
Sulphuric acid	25.00	.296	.391	.494	.578
Nitric acid	70.00	.056	.149	.187	.232
Nitric acid	22.00	.124	.130	.167	.234
Hydrochloric acid	35.00	.266	.354	.528	.674
Hydrochloric acid	20.00	.234	.292	.352	.397
Hydrofluoric acid	.25	1.460	.602	.644	.644
Sulphuric acid Nitric acid	1/5 of 96.00 1/20 of 70.00	.158	.188	.318	.388
Ammonium hydroxide	28.00	.020	at 20°C .046	at 20°C .057	at 20°C .062
Sodium hydroxide	10.00	1.602	.937	1.453	2.302
Sodium hydroxide	2.00	.646	.604	.436	.292
Calcium hydroxide	Sat. Sol.	.026	at 20°C .032	at 20°C .046	at 20°C .062
Ammonium chloride	10.00	.028	.041	.053	.076
Zinc chloride	10.00	.024	.084	.123	.142
Zinc chloride	5.00	.057	.032	.044	.052

Every piece under test was examined for any change in physical condition after it had been in the solution for the periods of 1, 10, 20 and 30 days. All pieces with one exception were found to have firm, sharp edges and were apparently as strong as when first immersed. The exception was the sample in sodium hydroxide. Here the edges were affected and somewhat rounded, as was to be expected.

These plates will withstand rather severe heat conditions. A sudden rise from 20 deg. C. to 100 deg. C. will have no effect on them. When gradually heated, they can be used at 900 deg. C. After use they can be baked to remove adhering matter. The expansion is approximately 1/14 in. in 10 ft., being 0.000006 from 20 deg. C. to 100 deg. C. and 0.000007 from 20 deg. C. to 900 deg. C.

Microscopic examination of these plates is said to show that they are homogeneous, that all grains are angular and are joined together at the points of contact with an aluminous glass bond. Each grain is covered with a vitreous coating. The strength of the plates is given in the following table:

Standard plate 12 x 12 x 1 in.	Average permeability of dry plate in cu.ft. of air per minute per sq.ft. at 2 in. water pressure.	Average modulus of rupture in lb. per sq.in.		Average transverse strength in lb. using wet modulus.
Grade		Dry	Wet	
Coarse	37.8	2684	2235	3576
Medium	16.9	3045	2644	4230
Fine	4.1	3770	3716	5954

The porosity of this plate is claimed to be uniform. The pore space, by volume, of plates passing different quantities of air is shown in the following table:

Amount of air passed through the dry plate 12x12x1 in. in one minute with 2 in. of water pressure registered underneath	Per cent of pore space byvolume
4.4 cu.ft.	36.04
7.4	32.53
9.0	33.31
15.9	31.77
18.5	35.33
41.6	33.88
43.3	33.27
66.0	33.88

These plates also have a high capillarity. On account of this it is necessary to saturate the plates with water before pouring cement around them for sealing in a container. Also, when a liquor is to be filtered through this ware, the plates should be first saturated with the filtrate. This will prevent any finely divided solids from being drawn into the pores by capillary action.

The plates are made in three grades: coarse, medium, and fine. The standard size is 12x12x1 in. Other sizes, in squares, rectangles, disks, tubes and cylinders, etc., are furnished as desired.

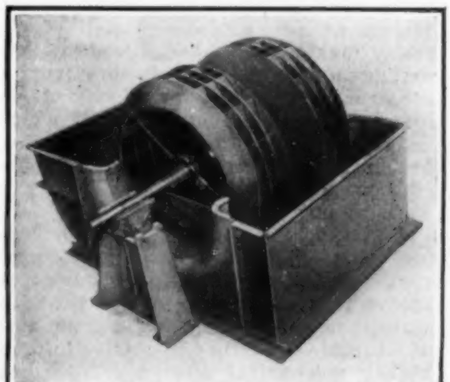
These plates are recommended for use in filtering, oxidation, agitation, absorption and humidifying, as well as in the activated sludge process, for which they were originally developed.

High-Speed Fan

Out of the needs of the modern boiler plant have grown many developments of benefit to industry in general. One of the latest of these is the new "high-speed" fan manufactured by the American Blower Co., Detroit, Mich. This fan has been designed primarily to supply draft for large boilers equipped with stokers—a unit of equipment that has increased greatly in size and capacity in the last few years.

High-speed fans are not new, so far as regards tip speed or revolutions of the impeller for a given capacity and pressure. But the application of high-speed fans to work where large volumetric capacities and relatively high pressures are necessary is a rather recent development. This type of fan has marked advantages for this kind of duty, because of the wide range of its capacity without material change in the power consumed. When properly selected for the duty required, it has a non-overloading power characteristic such as does not prevail in other types of fans. Furthermore, the high-speed fan lends itself to direct attachment to electric motors or steam turbines much better than any other type of fan, because the speed at which it runs more nearly approximates the standards for such motors and turbines.

Within the past 2 years a large number of these fans, called the "American H. S. Fan," have been installed in several of the largest central power plants in this country, where their perform-



High-Speed Fan With Upper Half of Casing Removed

ances have been satisfactory. The remarkably high efficiency of the American H. S. Fan, the low and uniform horsepower required over a wide range of capacity, its smooth and comparatively quiet operation after months of continuous running are claimed by the makers to have demonstrated conclusively that this blower is in a class by itself.

The fan is of the centrifugal type. The impeller has blades curved backward from the direction of rotation, which not only permits of high shaft speeds but also provides a pressure building and non-overloading characteristic so necessary in forced draft work, with its wide range of pressures to meet all conditions of boiler operation.

The distinguishing features of the fan are:

1. Streamline design of air entering orifices or blower inlets. These cast streamline inlets reduce air entering losses to a minimum and allow air to fill blower wheels without setting up unnecessary turbulence, as is experienced with inlets made into conical shapes. These inlets, being cast and carefully machined, not only provide a means of making a very rigid blower side but allow for close clearance with wheel inlets.

2. The impellers or wheels are designed so as to keep a uniform velocity of air through the wheel and thereby reduce wheel loss. In the sizes that require support other than that provided by the back plate—that is, on sizes with wheels larger than 42 in. in diameter, driving arms rigidly fastened to stiffening rings are provided. These arms are warped to approximate a disk fan blade pitch and thereby eliminate obstruction to the flow of entering air. This also obviates the troubles experienced by the use of stay rods and their adjustment.

3. There are two single inlet impellers or wheels to each blower of the double inlet type. These wheels are so spaced as to allow for the proper expansion of the air leaving the wheels and entering the discharge chamber of the blower casing or scroll. This plan of expanding the air after it leaves the wheels results in a larger volumetric capacity for given wheel dimensions. All previous designs have allowed for expansion on the inlet sides of high-speed wheels, but no provision was made for expansion on the opposite or drive side, as only one driving plate was used for a double inlet wheel, really making two wheels in one. This arrangement, while satisfactory from a constructional standpoint, does not allow for regain by conversion of wheel velocity into effective casing pressure, or for increased capacity, which is possible with two single wheels properly spaced apart.

4. A specially designed scroll or casing with expanding outlet is so proportioned as to afford the maximum recovery from velocity pressure to static pressure with the least amount of turbulence, thereby effecting a higher mechanical efficiency than has heretofore been produced by a blower for this kind of service. The air flows evenly and smoothly into the wind box or air ducts at a velocity consistent with the best stoker practice.

Sack Cleaner

Many industries that receive or ship dry granular or powdered materials in sacks are confronted with the necessity of cleaning these sacks before they can be used again. Also, the material recovered by such cleaning is valuable, either as a part of the material shipped in the bags or as a byproduct. Such industries will be interested in a new device placed on the market by the Robinson Manufacturing Co., of Muncy, Pa., for cleaning bags. This machine, in addition to cleaning the bags, does much to eliminate dust around the plant.

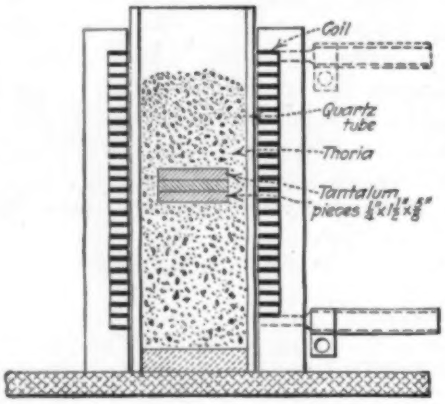
It consists of a large cylinder of wire screen cloth with wooden ends. This cylinder is driven by means of a chain and sprocket drive direct from the drive shaft and revolves inside of a dustproof case. The bottom of this case is constructed in the shape of a hopper to allow the material removed from the bags to travel down into a conveyor.

The sacks are inserted through a door in the side of the casing and one in the corresponding end of the cylinder, into the inside of the cylinder. When the cylinder is then rotated, the bags are tumbled until all the material adhering to them is knocked off and they are thoroughly cleaned. The loosened material passes through the screen, into the hopper bottom of the casing and thence into the conveyor. This takes it to the side of the machine where a carrier elevates it and deposits it on a screen over a bagging spout. The fine material falls through this spout into a bag or other receptacle, while a brush cleaner removes the coarse material such as strings, etc., to another opening, where it is discharged.

Melting Metal at 2,900 Deg. C.

Tests have recently been conducted by the Ajax Electrothermic Corporation, Trenton, N. J., on melting metallic tantalum by high-frequency induction. According to the Bureau of Standards, the melting point of this metal is 2,900 deg. C., hence this result is rather unusual.

The arrangement of the furnace used is shown in the accompanying sketch.



Outline Sketch of High-Temperature Electric Furnace

A current of about 160 amperes at about 25,000 cycles per second was passed through the coil. The frequency was not read on an instrument but was estimated from previous experiences with similar devices. The power was derived from a standard 35-kva. Ajax-Northrup high-frequency converter, operating from a 220-volt, sixty-cycle, single-phase line. The coil contained about twenty-five turns of flattened edgewise wound copper tubing, through which flowed about 3 pints of cooling water per minute. The power was read on a standard G. E. indicating wattmeter and showed 22 kw. throughout.

The power consumed, therefore, was 1.1 kw.-hr. and the metal melted per kw.-hr. was 0.25 of a pound avoirdupois. The pieces of tantalum were piled horizontally in the furnace, completely surrounded by powdered thoria, as shown in the cut.

The type of furnace used here is the same as that used in the development of "Permalloy." No resistance material or arc is required with it and there is no electrical contact between the source of power and the material to be melted. The "lines of force" set up by the coil pass through the quartz tube and the thoria, as they would through any other non-conductor, and set up eddy currents in the metal to be melted. These eddy currents heat the charge until the radiation losses equal the energy or heat input. In the case of this test, the equilibrium temperature was above 2,900 deg. C. in order to melt the tantalum.

Manufacturers' Latest Publications

Esterline-Angus Co., Indianapolis, Ind.—Bulletin 724. A bulletin describing improvements in meter clocks for graphic meters, a new recorder for low pressures and other products.

Norton Co., Worcester, Mass.—A catalog entitled "Norton Floors," in which is described and illustrated the use of the abrasive "Alundum" in floor construction.

Cambridge Instrument Co., 45 Grosvenor Place, London, S. W. I., England—A new folder on dial thermometers.

Pfaudler Co., Rochester, N. Y.—The first issue of a new house organ issued by this company which is to deal with the use of glass-lined equipment in the dairy and allied industries and is to be called *The Glass Lining.*

Century Wood Preserving Co., Pittsburgh, Pa.—A new data sheet on the cost of preservative treatment for cross-ties.

The Thermal Syndicate, Ltd., 350 Madison Ave., New York, N. Y.—A booklet entitled "Vitreosil Data," giving specifications for equipment made of this material.

W. H. Nicholson & Co., Wilkes-Barre, Pa.—Catalog 24. A new illustrated catalog of steam specialties for power plants, heating systems, industrial plants, etc.

American Blower Co., Detroit, Mich.—Bulletin 1103. A bulletin describing the new type H. S. fan, a double inlet blower for high-speed service.

Cutler-Hammer Mfg. Co., Milwaukee, Wis.—Publication 3082. A new illustrated catalog describing electric elevator control equipment.

Leeds & Northrup Co., 4901 Stenton Avenue, Philadelphia, Pa.—Catalog 48. An illustrated catalog describing apparatus for measuring the conductivity of electrolytes.

Illinois Stoker Co., Alton, Ill.—Catalog L, Third Edition. A new edition of the catalog of the Illinois chain grate stoker with dampered air control for forced or natural draft.

Books Received

A Digest of Chemistry and Chemical Industry

CHEMICAL ENCYCLOPEDIA. By *C. T. Kingzett, F.I.C., F.C.S.* Third edition, 606 pages. D. Van Nostrand Co., New York. Price, $8.

In this third edition of "The Popular Chemical Dictionary," the title has been changed, as it was felt that the original title might imply that it was not strictly scientific in character and accurate in detail. The new edition is much larger and more comprehensive than the earlier one. It has been the author's aim to provide an epitomized digest of chemistry and its industrial applications in a form that would be useful not only as a reference work for professional chemists but also for business men and others who have occasion from time to time to acquire information respecting the thousands of materials and subjects treated. The alphabetical arrangement with suitable cross-references makes it easy to locate the desired information.

Spectroscopy

SPECTROSCOPY. By *E. C. B. Baly*, Grant Professor of Inorganic Chemistry, University of Liverpool. Third edition, in two volumes. Vol. I, 298 pages. Illustrated. Longmans, Green & Co., New York and London. Price, $5.

Since the last edition was printed new fields of investigation have been opened up and the limits of knowledge in the older fields have been pushed very far forward. It has not been possible to comprise within one volume any account, however brief, of the whole, and it has, therefore, been decided to divide the book into two volumes. The first volume deals with the standard methods of work in the infra-red, visible and ultra-violet regions of the spectrum and thus includes the first half of the original volume.

Comprehensive Treatise on Colloids

THEORY AND APPLICATION OF COLLOIDAL BEHAVIOR. Contributed by the foremost authorities in each division of the subject. Edited by *Robert H. Bogue, Ph.D.*, director of research, Portland Cement Association. 829 pages, two volumes, illustrated. McGraw-Hill Book Co., New York. Price, $8.

Realizing that it has become almost if not quite impossible for a single individual to keep in close touch with the ever-expanding phases of colloid chemistry, Dr. Bogue has enlisted the aid of thirty-four specialists in preparing this first advanced, comprehensive treatise covering both theory and application. In Vol. I, on theory, Wilson, Loeb, Northrup and Van Slyke have treated heterogenous equilibria; Burton, Harkins, Hildebrand and Holmes, surface kinetics; Michaelis, Bancroft, Taylor, Freundlich, Thomas and Armstrong, adsorption and catalysis; Weiser, McBain and Bingham, structure.

Vol. II covers the applications of colloid chemistry as follows: Minerals, Lindgren; soil, Whitney; metals and alloys, Gillett; coal, coke and tar, Fieldner, Thiessen and Davis; colloidal fuel, Sheppard; smoke precipitation, Strong; silica and its derivatives, Stericker; cereals, Alsberg; fruit jellies, Tarr; cellulose and its derivatives, Esselen; rubber, Whitby; colloids in the dietary, McCollum; leather, Procter; gelatine and glue, Bogue; photography, Sheppard; casein and dairy industry, Zoller; sanitation, Wilson.

Within the comparatively few years that have elapsed since the first attempts were made to place colloid chemistry on a firmer foundation than empiricism, progress has been remarkable. But with the stimulus provided by this careful presentation of present knowledge, we may look forward to even greater progress in the near future.

Seasonal Construction

SEASONAL OPERATION IN THE CONSTRUCTION INDUSTRIES: THE FACTS AND REMEDIES. Report and recommendations of a committee of the President's conference on unemployment, with a foreword by Herbert Hoover. 213 pages. McGraw-Hill Book Co., New York, N. Y. Price, $2.50.

As a result of a careful study, this committee reports that custom, not climate, is mainly responsible for seasonal idleness in the construction industry. It is the general rule that the building trades are occupied wholly for only 3 to 5 months in the year. Many of the seasonal ups and downs are undoubtedly preventable, and the construction industries are grappling with the problem; they now need and should have the support of the general public.

Review of Recent Patents

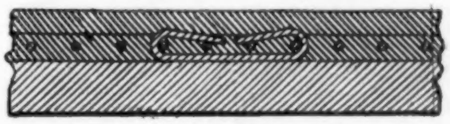
Purifying Natural Graphite

Max Langheinrich, of Munich, Germany, points out that heating alone is not sufficient to eliminate impurities in natural graphites, because of the tendency to form carbides and to change in structure from flakes to an amorphous form. But if coal is mixed with the natural graphite and the mixture heated above 2,200 deg. C. in an electric furnace, the impurities will be removed without changing the structure of the graphite. The impurities seem to form carbides more readily with the coal and these carbides are in turn decomposed at higher temperatures and volatilized. Similarly oxygen released from decomposing oxides unites with the coal rather than with the graphite. As a result, a graphite is obtained that is almost chemically pure (up to 99.9 per cent carbon) and that retains its original structure, although the impurities have been removed. (1,506,537, assigned to Graphitwerk Kropfmühl A. G., Munich, Germany, Aug. 26, 1924.)

Rubber-Lined Metal Tank

Ferdinand F. Brucker, of Akron, Ohio, has overcome the difficult problem of rubber-lining metal tanks by the following construction, shown diagrammatically in the accompanying illustration. To the inside of the metal walls anchoring devices are fastened at intervals. These may take a variety of forms, the one shown consisting of a sheet metal staple welded to the tank wall. The projecting prongs of each staple are forced through a lining sheet of rubber containing woven wire fabric as reinforcing material. The prongs are then flattened to hold this first lining in close contact with the walls.

A protective sheet is then placed over the foundation or anchoring sheet and pressed firmly into contact therewith. The operation having been repeated for all of the walls to be covered and the edges of the sheets at the corners having been pressed into intimate contact, the tank is then subjected to the proper vulcanizing temperature to cure the foundation and overlying layers into a homogeneous lining, which, as will be readily seen, is firmly and permanently bound to the metal walls of the tank.



Rubber Lining for Metal Tanks

Preferably the rubber compounds contain an accelerator that will enable the curing to be effected at a relatively low temperature—for example, by filling the tank with water hea ed to required temperature. (1,506,288, assigned to Miller Rubber Co., Akron, Ohio, Aug. 26, 1924.)

Casein Glue

Henry L. Prestholdt, of Minneapolis, Minn., has developed the following adhesive composition, which may be distributed in dry form:

	Parts
Casein	50 to 75
Dextrine	2 to 8
Starch	3 to 12
Calcium hydroxide	6 to 12
Magnesium oxide	10 to 20
Sodium hydroxide	2 to 8

When the dry powder is mixed with water, reactions occur that develop the adhesive properties. Calcium hydroxide in solution with casein forms a calcium caseinate, imparting waterproof qualities to the glue powder. Sodium hydroxide digests the starch and is a casein solvent. The hydroxide of soda, in combination with calcium hydroxide, would effect the solution of the glue

powder, but it would quickly become gelatinous and set up. Magnesium oxide is introduced for the purpose of retarding this process, which it does and imparts to the glue solution a liquid life of several hours. (1,506,202, Aug. 26, 1924.)

Casein Size

As ordinarily made by alkali treatment, casein size cannot be used with pulp colors in wall paper printing, for example, because of its reaction with the acid colors used, resulting in changes of shade. It has been necessary to use animal glues or starch glues, which are not waterproof, with the result that the colors run when wet.

Adrien E. Regnier, of Revere, Mass., has found that a size of acid reaction may be made by treating casein with sodium fluoride. Casein precipated by hydrochloric acid gives best results. From 8 to 16 lb. sodium fluoride is heated to 160 deg. F. with 100 lb. casein and 400 lb. water. Mixtures of casein and sodium fluoride may also be shipped dry and made into size as desired. Addition of ammonium oxalate or trisodium phosphate decreases the viscosity of the size without reducing its adhesiveness. (1,506,081, one-half assigned to Reginald W. Bird, Framingham, Mass., Aug. 26, 1924.)

Water-Resistant Glue

Alfred C. Lindauer and George M. Hunt, of Madison, Wis., have found that the addition of paraformaldehyde to animal glues gives high water resistance. Suitable proportions are 100 parts animal glue, 225 parts water and 10 to 30 parts paraformaldehyde. (1,506,013, assigned by mesne assignments, to the citizens of the United States, Aug. 26, 1924.)

Latex in Parchment Paper

Latex diluted with 10 volumes of water is mixed with a measured quantity of refined paper pulp and coagulated with alum or acid. This causes the colloidal particles of rubber to unite in a reticulated structure, which forms a thin film around the individual fibers. This film is insoluble in water. The paper is then run out on a paper machine, a cellulose gelatinizing agent such as zinc chloride or sulphuric acid introduced, the excess acid removed and the paper dried and pressed. About 5 per cent of latex in the finished sheet has been found to improve materially the flexibility, moisture resistance and dielectric properties. (1,506,317, Thomas C. Marshall, of Yorklyn, Del., and James L. McClellan, of Kennett Square, Pa., Aug. 26, 1924.)

U. S. Patents Issued September 16, 1924

Glass-Grinding Machinery. Edward T. Brown, Detroit, Mich., assignor to Ford Motor Co., Detroit, Mich.—1,508,378.

Apparatus for Producing Gas From Liquid in a Cold State. John Kohut, Boonton, N. J.—1,508,399.

Pharmaceutical Product. Walter Kropp and Ludwig Taub, Elberfeld, Germany, assignors to Farbenfabriken vorm. Friedr. Bayer & Co., Leverkusen, near Cologne-on-the-Rhine, Germany.—1,508,401.

Method and Means for Separating Gases or the Like. Edoardo N. Mazza, Turin, Italy, assignor, by mesne assignments, to the A. F. Syndicate, New York, N. Y.

Dyestuff. Heinrich F. Raeder and Walter Mieg, Vohwinkel, Germany, assignors to Farbenfabriken vorm. Friedr. Bayer & Co., Leverkusen, near Cologne-on-the-Rhine, Germany.—1,508,409.

Process of Recovering Absolute Alcohol. Arthur A. Backhaus, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.—1,508,435.

Apparatus for Recovering Absolute Alcohol Free From Foreign Materials. Arthur A. Backhaus, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.—1,508,436.

Method of Making Green Scales. Walter Glaeser, Brooklyn, N. Y.—1,508,448.

Manufacture of Aluminum Chloride. George W. Gray, New York, N. Y., and Frank W. Hall, Port Arthur, Tex., assignors to the Texas Co., New York, N. Y.—1,508,451.

Glass. Charles A. Kraus, Worcester, Mass.—1,508,455.

Pyroxyline and Method of Making the Same. William G. Lindsay, Newark, N. J., assignor to the Celluloid Co.—1,508,457.

Pyroxyline Composition and Process. John H. Stevens, South Orange, N. J., assignor to the Celluloid Co.—1,508,483-484.

Device for Introduction of the Electrodes in Electric Furnaces. Filip Tharaldsen, Christiania, Norway.—1,508,486.

Machine for Removing the Booster Charge From a High-Explosive Shell. Gustave Allison, Perth Amboy, N. J., assignor to Columbia Salvage Corp., New York, N. Y.—1,508,494.

Instrument for the Automatic Determination of Moisture in Paper or Textiles. Arthur R. Harvey, Middletown, O.—1,508,516.

Calcining Furnace. Eugene A. Hults, Saltville, Va., assignor to Mathieson Alkali Works.—1,508,555.

Making Castings of Aluminum Alloys. Zay Jeffries, Cleveland Heights, and Robert S. Archer, East Cleveland, O., assignors to Aluminum Co. of America, Pittsburgh, Pa.—1,508,556.

Method for Producing Chromium or Alloys of Chromium. Bo Michael Sture Kalling and Sven Dagobert Danieli, Trollhattan, Sweden, assignors to Aktiebolaget Ferrolegeringar, Stockholm, Sweden.—1,508,557.

Process for Rendering Ether Air-free. Edward Mallinckrodt, Jr., St. Louis, Mo., assignor to Mallinckrodt Chemical Works, St. Louis, Mo.—1,508,563.

Treating Chromium-Iron Alloys. John H. Nead, Middletown, O., assignor to the American Rolling Mill Co., Middletown, O.—1,508,567.

Grape Sugar. William B. Newkirk, Riverside, Ill., assignor to Corn Products Refining Co., New York, N. Y.—1,508,569.

Brake for Gyratory Centrifugals. Eugene Roberts, Salt Lake City, Utah, assignor to the Western States Machine Co., Salt Lake City, Utah.—1,508,577.

Apparatus for the Distillation of Coal and Other Substances. Arnold Ruhr, Nuremberg, Germany, assignor to Kohlenscheidungs-Gesellschaft m.b.h. Berlin, Germany.—1,508,578.

Process of Preparing Bismuth Salts of Mercurated Organic Compounds Containing an Acid Residue and the Products Obtainable Therefrom. Wilhelm Kolle, Hugo Bauer, and Ernst Maschmann, Frankfort-on-the-Main, Germany, assignors to Farbwerke vorm. Meister Lucius & Bruning, Hochst-on-the-Main, Germany.—1,508,603.

Negative Plate for Electric Accumulators. Adolfo Pouchain, Turin, Italy.—1,508,613.

Dehydrated Lignite and Process of Producing the Same. Eugene P. Schoch, Austin, Tex.—1,508,617.

Method of Bleaching Petroleum Products With Clay. Charles W. Stratford, San Francisco, Calif.—1,508,625.

Method of Producing Molybdenum and Molybdenum Compounds. George D. Van Arsdale, Rush T. Sill, and Harley A. Sill, Los Angeles, Calif.—1,508,629.

Diagonal-Flow Meter. Lyle G. Chase, Philadelphia, Pa., assignor to Yarnall-Waring Co., Philadelphia, Pa.—1,508,677.

Finished Sheet Material and Method of Finishing the Same. Lloyd M. Perry, Nashua, N. H., assignor to Nashua Gummed & Coated Paper Co., Nashua, N. H.—1,508,720.

Process for the Production of Ammonium Compounds. John H. West, Bayswater, London, and Arthur Jaques, Waterloo, near Liverpool, England.—1,508,736.

Electrolytic Apparatus. William G. Allan, Toronto, Ont., Canada, assignor, by mesne assignments, to John P. Scott, Toronto.—1,508,758.

Process of and Apparatus for Treating Oils. Robert W. Bissell, New York, N. Y., assignor to Vegetable Oil Securities Co., Pittsburgh, Pa.—1,508,769.

Clay-Forming Die. Davis Brown, Bucyrus, O.—1,508,773.

Storage-Battery Plate. Thomas R. Cook, Pittsburgh, Pa., assignor to Westinghouse Union Battery Co., Swissville, Pa.—1,508,776.

Process for Producing and Utilizing Alkalis and Alumina. Alfred H. Cowles, Sewaren, N. J., assignor to the Electric Smelting & Aluminum Co., Sewaren, N. J.—1,508,777.

Method of Manufacturing Carbureted Water Gas. George W. Smith and Frank L. Weisser, San Antonio, Tex.—1,508,807.

Method of and Apparatus for Making Castings. John Kralund and Clarence H. Duckworth, Brooklyn, N. Y., and Marcus Stern, Toledo, O., assignors to Doehler Die Casting Co., Brooklyn, N. Y.—1,508,889.

Composition of Matter for Use in Lieu of Leather or for Other Suitable Purposes and Method or Process of Manufacturing Same. William Stocks, Fitzroy, Victoria, Australia.—1,508,899.

Process for Producing a Composition of Matter for Use in Lieu of Rubber, Leather or for Other Suitable Purposes. William Stocks, Fitzroy, Victoria, Australia.—1,508,900.

Method of Treating Vulcanized Rubber and of Mixing Same, Etc. William Stocks, Miramar, near Wellington, New Zealand.—1,508,901.

Apparatus for Separating Oil From Oil Sands. Nicholas S. Clarke, New York, N. Y., assignor to Athabasca Oil Products, Ltd., Edmonton, Alta., Canada.—1,508,923.

Plastic Containing Cellulose Acetate. Henry Dreyfus, London, England.—1,508,928.

Method of Forming Ingots. Emil Gathmann, Baltimore, Md.—1,508,931.

Process and Apparatus for Making Wall Board and the Like. Paul B. Hudson, Watertown, N. Y.—1,508,973.

Crushing Rolls. Francis J. Straub, New Kensington, Pa.—1,509,005.

Discharging Device for Electric Furnaces. Carl T. Thorssell, and Ebbe Christian Beck-Friis, Gottenberg, Sweden.—1,509,007.

Machine for Straining Paper Pulp and the Like. John Paramor, Watford, England, assignor of one-half to the Watford Engineering Works, Ltd., Watford, England.—1,509,024.

Manufacture of Cellulose. Fred C. Thornley and Frank F. Tapping, Knightsbridge, London, and Otto Reynard, Inkerman Terrace, London, England; said Tapping and said Reynard assignors to said Thornley.—1,509,035.

Process for the Utilization of Seaweed. Fred C. Thornley and Frank F. Tapping, Knightsbridge, London, and Otto Reynard, Inkerman Terrace, London, England; said Topping and said Reynard assignors to said Thornley.—1,509,035.

Fertilizing Composition. Roy H. Hoover, Freeport, Ill., assignor to R. H. Hoover Laboratories, Inc., Freeport, Ill.—1,509,062.

Treatment of Soy Beans. Laszlo Berczeller, Budapest, Hungary.—1,509,076.

Imperishable Butter. Charles E. North, Montclair, N. J., assignor to the Milk Oil Corp., Wilmington, Del.—1,509,082.

Imperishable Milk. Charles E. North, Montclair, N. J., assignor to the Milk Oil Corp., Wilmington, Del.—1,509,083.

Process of Churning Cream. Charles E. North, Montclair, N. J., assignor to the Milk Oil Corp., Wilmington, Del.—1,509,084.

Process for Whipping Reconstructed Cream. Charles E. North, Montclair, N. J., assignor to the Milk Oil Corp., Wilmington, Del.—1,509,085.

Process of Making Butter From Milk Oil. Charles E. North, Montclair, N. J., assignor to the Milk Oil Corp., Wilmington, Del.—1,509,086-087-088.

Attrition-Mill Separator. John J. Czarev, Henry H. Whitley and Michael Kreuser, West Allis, Wis.—1,509,089.

These patents have been selected from the latest available issue of the "Official Gazette" of the United States Patent Office because they appear to have pertinent interest for "Chem. & Met," readers. They will be studied later by "Chem. & Met.'s" staff, and those which, in our judgment, are most worthy, will be published in abstract.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

News of the Industry

Summary of the Week

American Society for Steel Treating has large attendance at annual convention in Boston.

Trade associations seek to have definite statement regarding legal limitations of the functions of the associations.

Retail druggists, at annual convention, go on record as opposed to passing of the Cramton law.

Tariff Commission sends questionnaire to dye manufacturers asking for data on sales by quantity and value.

Naval stores operators issue preliminary report after study of French naval stores industry.

Survey of nitrogen situation in European countries shows German production has gained since war years.

Program announced for semi-annual meeting at Detroit, Oct. 2 to 4, of American Electrochemical Society.

Ruling of Internal Revenue Commissioner grants no reimbursement of taxes to distributors of alcohol when latter has been lost or destroyed.

Naval Stores Men Impressed by French Industry

The commission of American naval stores operators which recently returned after a study of the French naval stores industry has submitted a preliminary report. The Americans were very much impressed with what they saw and believe several leaves may be taken from the book of French practice and applied to advantage in this country. The outstanding lesson taught by an inspection of the French producing area is that trees can be tapped so that their life is prolonged indefinitely, in sharp contrast with the destructive slashing in this country which has reduced the life of a tree to 5 years.

Prompted by the trip of the American commission, the Department of Commerce is publishing an extended report on the French industry. It reviews briefly the striking development which in less than 100 years has transformed the region of southwestern France from a barren stretch of coastal sand dunes into one of the most productive spots in the entire republic. The region was systematically forested with a pine of rapid growth. The work of forestation was completed in 1865. Today that strip of coast which was non-productive and barren furnishes 25 per cent of the world's output of naval stores. The output comes from 180 plants. During the years of heaviest production 15,000 men are employed in gathering the raw material. In 1920 the output sold for 430,000,000 francs. The 1923 production of turpentine was 30,000 tons, while that of dry products approximated 112,000 tons.

Business-like steps are being taken to develop new uses for naval stores and to increase the consumption in the lines in which they already are used. Much progress has been made as a result of this research work. Work is being done on synthetic perfumes and synthetic camphor. A soap containing a high percentage of rosin also is being developed. Study also is being made of processes for the manufacture of wood pulp.

Tariff Commission Seeks Data on Sales of Dyes

In order that the Tariff Commission may be in a position to inform Congress of the developments in the coal-tar dye industry in view of the automatic reduction in the ad valorem rate of duty which became operative Sept. 22, the commission has sent a questionnaire to domestic producers inquiring of each the total sales of dyes by quantity and value for the first 9 months of 1923 and similar information for the corresponding period of 1924.

Manufacturers also are asked to give their reasons for any change in volume of sales during 1924 as compared with the previous year. The information given the commission will be treated as confidential and the data will be revealed only in the form of totals or averages, so that the operations of individual firms will not be revealed.

It is the purpose of the commission to send out a similar questionnaire early in January, asking similar information of sales for the last 3 months of 1923 and 1924.

While sales of coal-tar dyes this year are expected to show a considerable decrease under those of 1923 because of lack of demand due to depression in the consuming industries this year, the commission expects to be able to draw deductions of the effects of the reduction in duty effective Sept. 22 by comparing monthly average sales for the first 9 months of 1924 with those of the last 3 months, and by comparing the two periods of this year with the corresponding periods of 1923.

Alcohol Interests Protest Cuban Embargo on Molasses Exports

Indications that the Cuban Government is about to place an embargo on exports of blackstrap molasses has brought forth a determined protest from manufacturers of industrial alcohol and of mixed feeds to the State Department and Department of Commerce. It is contended that any interference on the part of the Cuban Government with the supplies under contract to American interests would constitute an unfriendly act.

Production of alcohol in Cuba has grown in leaps and bounds during the last 5 years. Cuban distillers used 32,000,000 gal. of blackstrap in 1923. More than 34,000,000 gal. has been used thus far this year. Additional supplies are badly needed by the distillers, who contend that they cannot secure them because all stocks in the country are under contract to American concerns. The objection of the Cuban Government is said to be based on the fact that its revenues will be disrupted through loss of the tax collected on alcoholic beverages, were the distilleries forced to close down. The American interests contend that the export tax on molasses will more than cover any loss that might come through the enforced idleness of the Cuban distilleries. They point out that they went into the open market and made their contracts when they were open alike to the Cuban distillers. If the latter overestimated their requirements, it is no reason why the Americans who made a better estimate of their requirements should be penalized. The American interests, however, do not believe that all the blackstrap in Cuba is under contract. It is their thought that the Cuban distillers are not pleased with the price being asked for blackstrap at this time and have taken this method of attempting to beat down the market.

Interesting Program for A.E.S. Meeting at Detroit

One of the features of the forty-sixth semi-annual meeting of the American Electrochemical Society, which will be held in Detroit, Oct. 2 to 4, will consist in a group luncheon and round-table discussion of Electric Furnace Cast Iron. This will be conducted by the Electrothermic Division on Thursday noon, Oct. 2, at the Hotel Tuller.

The round table will engage in informal discussion of live topics having to do with this new branch of cast-iron metallurgy; there will be no papers. No stenographer will be present to take down the discussion, because freedom of discussion is the main object of this type of meeting.

The chairman of the meeting will be George K. Elliott, Cincinnati, Ohio, who is one of the pioneers in this field. Dr. Richard Moldenke, one of the best known of iron metallurgists, will make the opening discussion. A number of experienced electric furnace operators have promised to attend, as also have foundrymen and representatives of the central power stations. In connection with this meeting also the local committee are arranging for a trip through the iron foundry of the Ford company.

The technical program for the meeting is as follows:

Wednesday, Oct. 1

3 p.m. Registration begins at Hotel Tuller.

6 p.m. Members and guests leave Hotel Tuller for Eastwood Inn for a "Get-together" subscription fish, frog and chicken dinner. Members of local scientific and technical societies are cordially invited.

Thursday, Oct. 2

9.30 a.m. Symposium on "Corrosion," Dr. B. D. Saklatwalla, chairman.

F. N. Speller, Film Protection as a Factor in Corrosion; Cecil H. Desch, The Micro-Chemistry of Corrosion; Ulick R. Evans, The Relation Between Tarnishing and Corrosion; J. Newton Friend, D. W. Hammond and G. W. Trobridge, The Influence of Emulsoids Upon the Rate of Solution of Iron; W. H. Hatfield. The "Stainless" Chromium Steels; F. N. Speller and F. G. Harmon, Comments on Electrolytic Theory of Corrosion by Wilder D. Bancroft.

12.30 p.m. Round-Table Discussion at luncheon, Hotel Tuller. "Electric Furnace Cast Iron," George K. Elliott, chairman.

2 p.m. Symposium on "Corrosion" continued.

C. M. Kurtz and R. J. Zaumeyer, The Corrosion of Iron Alloys by Copper Sulphate Solution; George P. Ryan, The Effect of Cold Working on the Corrosion of Metals; E. W. Greene and O. P. Watts, Effect of Reduced Pressure on the Rate of Corrosion of Amalgamated Zinc in Acid and in Alkali Solutions; William E. Erickson and L. A. Kirst, Tests for Grading Corrosion-Resisting Alloys; Colin G. Fink and Li Chi Pan, Insoluble Anodes for Brine. The Lead-Silver Series; H. S. Rawdon and A. I. Krynitsky, Notes on Corrosion Testing by Different Immersion Methods.

6 p.m. Meeting of the board of directors at dinner, Hotel Tuller.

Friday, Oct. 3

9 a.m. Symposium on "Industrial Electric Heating," Prof. C. F. Hirshfeld, chairman.

A. E. White, The Use of Electric Furnaces in Heat-Treatment; R. H. MacGillivray, Electric Furnace for Continuous Hardening and Tempering of Wire; Robert M. Keeney, Annealing of Brass Tubing in the Electric Furnace; F. S. Heath, Electric Brass Melting; Harry Allen, Electric Japanning.

Electric Furnace Refractories, Dr. M. L. Hartmann, chairman.

M. L. Hartmann and O. B. Westment, Thermal Conductivity of Carborundum Refractories; C. E. Sims, H. Wilson and H. C. Fisher, Preparation of Artificial Sillimanite; Frank T. Sisco, Fluorine in the Deoxidizing Slag and Its Influence on Refractories in Basic Electric Furnace Practice.

12.30 p.m. Round-Table Discussion at luncheon, Hotel Tuller. "Control Methods in Electrodeposition," in charge of O. P. Watts and William Blum.

2.30 p.m. Fr. Foerster, Electrolytic Chlorate as a Secondary Product. (The Electrolysis of Hypochlorite Solutions); Thomas P. Campbell, The Electrolysis of Ammoniacal Zinc Carbonate Solutions; M deK. Thompson, The Production of Chromates From Ferro-Chromium Anodes; Per K. Frölich, The Introduction of Carbonaceous Matter in Electrodeposited Iron and Nickel; H. E. Haring, Throwing Power, Cathode Potentials and Efficiencies in Nickel Deposition; Per K. Frölich, The Amphoteric Character of Gelatine and Its Bearing on Certain Electrochemical Phenomena.

8 p.m. Board of Commerce Auditorium, Alex Dow, president of the Detroit Edison Co., will address the Society upon "Central Station Design and Superpower."

Saturday, Oct. 4

9 a.m. M. Sem, The Söderberg Electrode: Recent Commercial Installations; J. R. Cain, Influence of Sulphur, Copper, Oxygen and Manganese on the Red Shortness of Iron; R. F. Mehl, Experiments on the Preparation of Very Pure Alloys and a Preliminary Study of Certain Electrical Properties of the System Al-Mg; Louis Kahlenberg and H. H. Kahlenberg, On the Preparation of Metallic Tungsten and Some of Its Alloys; H. C. P. Weber and R. H. Wynne, Halogenated Hydrocarbons and Dielectrics. IV. Effect on Flash and Fire Point of Transformer Oils; A. E. R. Westman and R. B. Walker: The Relation Between Current Voltage and the Length of Carbon Arcs. III. Alternating Currents.

Poland Increases Output of Potassium Salts

During the first 5 months of 1924, 30,663.8 metric tons of potassium salts was produced in Poland. This amount, consisting of 5,463.8 tons of kainite and 25,200 tons of sylvite, was an increase of 31.53 per cent over the output during the corresponding period in 1923 and was also larger than for any like period in previous years.

Bidle Nominated as President of A.S.S.T.

The International Steel Exposition held at Commonwealth Pier in Boston last week in conjunction with the sixth annual convention of the American Society for Steel Treating was by far the largest and most successful ever held. It covered twice the area of the record-breaking show at Pittsburgh a year ago and the steel industry was represented with gratifying completeness. Steels of every conceivable kind were to be seen in every form from the ingot to the finished manufactured product and most of the processes were seen in action. The machine tool exhibit alone was the largest of its kind ever assembled. The growth of the steel show year by year has now brought it to the point where it is the largest annual industrial exposition held in the United States.

Technical sessions of the convention were held daily at the pier and at the Copley-Plaza Hotel. Papers were presented by authorities from England, Germany, France, Japan, Sweden and other countries as well as by the leading American metallurgists. It would be hard to say which of the sessions aroused the greatest interest. If amount of discussion is a safe criterion the honors were divided between the papers on X-ray investigation of steel and the symposium on salt baths for heat-treating. The session on stainless steel was a close second.

Wednesday noon, Dr. George B. Waterhouse of M.I.T. gave a luncheon at the University Club to Dr. Kotoro Honda, of the Imperial University of Tokyo. The guests of this luncheon made up a noteworthy small gathering of metallurgists. Zay Jeffries, Albert Sauveur, E. C. Bain and Paul D. Merica were among those present.

At a special session on Wednesday, nominations of officers were made to be balloted on by mail by all members of the society. W. S. Bidle, of Cleveland, first vice-president, was nominated for president to succeed Dr. George K. Burgess, the present head of the society. Second Vice-President Robert M. Bird, of Philadelphia, was named for first vice-president. Secretary W. H. Eisenman and Treasurer Zay Jeffries, both of Cleveland, retain their positions.

At the banquet held on Thursday evening Kotaro Honda was made an honorary member of the soicety. He is the seventh scientist to receive such a honor. Francis S. Lucas was awarded the Henry Marion Howe medal for 1924 for his paper on making photomicrographs at high magnifications. By Lucas' method magnifications of 5,000 or 6,000 diameters are possible. This medal is awarded annually for the best paper presented during the year.

Glass Workers' Wages Reduced

Reports from Pittsburgh say a wage reduction of 10 per cent for cutters and flatteners employed by the American Window Glass Co. has been in effect since Sept. 1. The new scale was agreed upon by representatives of the workmen and the company last month.

Washington News

No Refund of Taxes on Alcohol Lost, Destroyed or Stolen

The Commissioner of Internal Revenue has approved an opinion rendered by the legal department of the Prohibition Unit which makes it impossible, under certain conditions, for the distributor of industrial alcohol to recover the tax paid when the alcohol is destroyed by fire, railroad wreck, or lost by other unavoidable cause. The Commissioner of Internal Revenue has declined to refer the matter to the Attorney-General for an interpretation of the statute covering tax reimbursement. It is fully expected that the industry will carry the matter to the courts.

The industry contends that the intent of the statute is to reimburse the taxpayer the entire amount of the tax paid on alcohol that has been lost through unavoidable cause. When alcohol is stolen through no fault of the owner, and the government refuses to return the entire amount of the tax paid, it is tantamount, it is contended, to participation in benefits of a theft.

Ruling Sought to Define Rights of Trade Associations

In an effort to secure an official ruling to define clearly the legal rights of trade associations in collecting and distributing statistics and other activities, a committee representing the Chamber of Commerce of the United States visited Attorney-General Stone, Secretary of Commerce Hoover and members of the Federal Trade Commission in Washington, Sept. 22.

The results of a referendum undertaken by the national chamber last year on trade association functions, together with supporting and explanatory data, were laid before the federal officials. No effort was made to secure an expression of opinion from the officials at the meetings Sept. 22, but they were asked to study the data presented them and to meet the chamber's committee again late in October, at which time it is hoped by the committee that there may be obtained an opinion which may be made public in order to determine uncertainties that now exist.

Each of eight proposals defining in rather general terms the proper scope of trade association functions laid before its membership by the Chamber of Commerce of the United States last year was given overwhelming approval, and thus these propositions became the policy of the national organization.

According to Richard F. Grant, of Cleveland, newly elected president of the Chamber of Commerce of the United States, it is the belief of officials of that organization that a trade association functioning along the lines laid down in the chamber's policy is clearly within the law. So much has been said recently, however, regarding the "twilight zone" of association activities in regard to the Sherman anti-trust law and there being no clear-cut judicial decision marking the line between legal and illegal activities, that conferences with the federal officials were sought in order to obtain, if possible, an official opinion that would form the basis of procedure.

If such an opinion is not obtained at the conference to be held in October, it is expected that the national chamber will proceed to draft suggested legislation which Congress will be asked to enact.

President Grant of the national chamber appears to think that it will be possible to secure an opinion upon which trade associations may act. Attorney-General Stone previously, however, in a conference with trade association executives had declined to give such an opinion because of the broad lines involved.

Mr. Grant does not believe that a test lawsuit, which has been suggested to clear the uncertainties existing regarding association work in statistics especially, is feasible, because of the time element involved, probably several years being required to secure a final decision from the Supreme Court, and also because he does not believe that it would be easy to induce an association to offer itself for such a test, owing to the apprehension of individual members that they might thereby come into personal conflict with the Department of Justice.

The committee on trade associations of the Chamber of Commerce of the United States, which called on the officials, in addition to President Grant, comprised Milton E. Marcuse, president of the Bedford Pulp & Paper Co., Richmond, Va.; George Rubles, attorney, Washington; Alfred Reeves, general manager of the National Automobile Chamber of Commerce, New York; and Elliot H. Goodwin, resident vice-president of the national chamber.

Cramton Bill Opposed by Retail Druggists Association

Strong opposition to enactment of the Cramton bill to create a separate prohibition bureau within the Treasury Department was expressed at the annual convention of the National Association of Retail Druggists, held in Washington, Sept. 22 to 26. Much of the discussion at the meeting revolved around legislation, with this measure emphasized.

It was made plain in the addresses of President J. H. Webster and General Counsel E. C. Brokmeyer and in the reports of the legislative and executive committees that the retail druggists desire in every way possible to co-operate in the enforcement of the Volstead act, but that they oppose onerous restrictions upon business activities which are permitted by this law.

If the Cramton bill is enacted by Congress and an independent bureau is made of the Prohibition Unit, the druggists would lose their present right of appeal to the Commissioner of Internal Revenue from decisions of the Prohibition Commissioner, it was emphasized. Demand was made that the Cramton bill be taken from the Senate calendar and referred to a committee for hearing, the charge being voiced that the measure, after having passed the House, was rushed to the Senate calendar by "sharp practices" and without an opportunity having been afforded opponents to present arguments.

The retail druggists also went on record as opposing administration of the narcotic laws by the Prohibition Unit, owing to the police methods of this agency.

Regret that Congress had not seen fit to reduce the tax on alcohol for medicinal use while it was revising the revenue law was expressed in the address of President Webster and in several committee reports. Products for the sick should be made just as cheaply as possible and to this end there should be low taxation, or none, upon them, it was declared.

The legislative committee expressed the hope that at the approaching session of Congress it will be possible to get a hearing on the resale price-fixing bills which have been pending several years.

State laws restricting ownership of pharmacies to registered pharmacists, modeled along that on the statute books of New York, were advocated for all states.

The retailers again renewed their assaults against various methods of cut-rate salesmanship, especially opposing contributions by manufacturers toward this end through part-payment of advertisements, "hidden demonstrators," etc.

The convention delegates were addressed Wednesday noon by President Coolidge, who lauded the ethics of the organization and spoke of high principles in business.

Dr. B. A. Browne, chief of the Bureau of Chemistry, Department of Agriculture, addressed the convention at its opening session, explaining the administration of the pure food and drugs act, and asking co-operation with the department in this function. C. C. Concannon, chief of the Chemical Division of the Department of Commerce, was prevented from delivering a scheduled address owing to illness, and his place was taken by E. W. Ely, of the Division of Simplified Practice, who spoke of the value of reduced varieties to the druggists.

Determination of Magnetite in Slags

A study of the determination of magnetite in slags is to be undertaken by the Interior Department at the Southwest Experiment Station of the Bureau of Mines, Tucson. Ariz. A survey of the literature of the subject has been made, and an outline of the method for undertaking the solution of the problem has been prepared.

News in Brief

Quality of Gasoline Improved—Despite the tendency to criticise the quality of gasoline offered for sale, the tenth semi-annual motor gasoline survey just completed by the Department of the Interior indicates that, on the whole, a better grade of gasoline is now being marketed than was offered for sale during the same season a year ago. Of the ten cities in which the survey was conducted by Bureau of Mines chemists, San Francisco ranked first in the average quality of marketed gasoline. Washington was the second city in this respect, with New York running a close third.

Community Dipping Vats Used in Wyoming—Community dipping vats in Platte County, Wyoming, are solving the problem of controlling animal parasites, which have caused heavy loss to livestock growers there for some years. The average cost of each of fourteen plants in use now is about $450 and the vats have a capacity of 3,000 gal.

Lectures at Mellon Institute—A course of lectures by specialists engaged in research in Mellon Institute of Industrial Research of the University of Pittsburgh will be given throughout the first and second semesters of the year. Each discourse will be an hour in length and will deal with raw materials, manufacturing processes, properties and uses of the technochemical products scheduled for discussion.

Tire Manufacture Increases—The manufacture of automobile tires in the Akron, Ohio, district has been advanced in the past few weeks to a total of 90,000 to 95,000 tires per day, and this output, it is said, will reach 100,000 daily at an early date. This is close to the peak production record for the present year, or 110,000 tires per day during the early spring months. Practically every mill in that section is adding to its working force and full working quotas are expected to obtain as the fall season matures. Plant expansion is also developing to provide for considerable increases in capacity.

Platt Addresses Lehigh Valley Chemists—The regular monthly meeting of the Lehigh Valley section of the American Chemical Society was held Sept. 19 at the Hotel Traylor, Allentown, Pa., with a large attendance. The speaker for the affair was Herbert Platt, of the American Cellulose & Chemical Manufacturing Co., New York, a recognized authority on the manufacture of artificial silk. He gave a very interesting account and talk on "Artificial Silk," explaining its discovery and adoption.

New York Syndicate Negotiates for Tar Sand in Canada—Headed by Roland Day, a syndicate of New York capitalists is negotiating with the Canadian Government for large tracts of tar sands in northern Alberta. The proposal amounts to the founding of a great industry in the district of Fort McMurray and the taking over and operating of the Alberta Great Waterways Railway. Such a proposition would require the investment of many millions of dollars. The law provides that no lease for tar sand property can be given by the Department of Interior until the applicant has produced his plan for the manufacture of it and the plan has been found reasonable and practicable by the departmental experts.

Druggists Praised by Dr. Browne—Members of the National Association of Retail Druggists were commended by Dr. C. A. Browne, chief of the Bureau of Chemistry, for the part they have played in placing the pharmaceutical preparations of this country upon a high level of purity. "The efforts of the Bureau of Chemistry to improve the quality of drugs on the American market and to devise methods for reducing their variability," said Dr. Browne among other things, "has met with the heartiest support of the trade. I know of no organization in a better position to influence manufacturers in improving the quality and purity of drugs, not only by the economic position which you occupy as purchasers but also by the moral encouragement which you can give toward securing a better enforcement of existing laws."

Chemical Company to Occupy New Plant—The Pitman-Moore Co., Indianapolis, Ind., manufacturer of chemical specialties, pharmaceutical products, etc., is arranging for the immediate occupancy of its new plant building at Madison Ave. and Morris St., now practically completed. This will be the third building to be used by the company in that city, and is said to form one of the most complete and efficient units of its kind in the country.

Mexico Begins Production of Carbon Dioxide—In a report from Yucatan, Vice-Consul Herman C. Vogenitz states that the use of carbonated water and beverages is increasing considerably in that locality. It is estimated that consumption has increased from approximately 100 cylinders in 1923 to 250 cylinders during the first 6 months of 1924. It is further stated that the manufacture of this gas has been started commercially in Mexico City and that future purchases will be largely effected in that market, in order to avoid the present high customs duties of 10 centavos per kilo on the imported product.

Beet Sugar in Canada—In his report for the fiscal year ended March 31, 1924, which has just been issued, Dr. F. T. Shutt, Dominion Chemist, points out that there is only one company in Canada making beet sugar at the present time. This company operates factories at Wallaceburg and Chatham in Ontario, and in 1921 had an acreage of 23,535, which yielded 199,334 tons of beets valued at $1,974,384 or $9.90 per ton. From this quantity of beets were produced 52,882,377 lb. of refined beet sugar, having at 8c. per lb. a total value of $4,545,154.

Dr. Wiley to Be Honor Guest at Agricultural Chemists Banquet

One of the features of the meeting of the agricultural chemists in Washington on Oct. 20 will be a banquet at which Dr. Harvey W. Wiley will be the guest of honor. On Oct. 18 Dr. Wiley will celebrate the eightieth anniversary of his birth. Every effort is being made to make the dinner an impressive occasion. This meeting of the association will be of unusual significance, since it will mark the fortieth anniversary of the foundation of the organization.

Tariff Has Failed to Stimulate Domestic Quicksilver Industry

Despite stimulus of the high tariff of 25c. per lb. on quicksilver, the domestic industry, in the opinion of competent observers, is not establishing itself on a substantial basis. Less than one-third of the country's requirements for this essential metal is being supplied from domestic sources. In 1923 it was necessary for the American public to pay an additional 25c. per lb. on the 1,568,551 lb. imported. Disinterested opinion is to the effect that the principal result of the duty has been to permit further gutting of American mines and the loss of reserves that would be of incalculable value were the country involved in a war that would render impossible the maintenance of communication with Spain and Italy.

While the peace-time uses of quicksilver do not fall in the same vital category as do its war-time uses, it nevertheless is an essential commodity. About one-half of our consumption goes into medicinals. There still is a substantial demand for it in connection with the recovery of gold and silver from their ores. It is being used in increasing quantities as a constituent in non-fouling paints. A substantial aggregate is used in the hat and fur industry and in the manufacture of mirrors, thermometers and barometers.

A further indication that it is folly to attempt to build up a domestic industry under present conditions is held to be the fact that American ores run only one-half of 1 per cent quicksilver, whereas those mined in Europe are from two to eight times richer.

Salt Production Gained in Volume in 1923

A statement issued by the Department of the Interior, based upon figures compiled in the Geological Survey, shows that the total quantity of salt sold or used by the producers in the United States in 1923 was 7,130,713 short tons, valued at $27,795,941. The total includes 2,787,000 tons of salt in brine, 2,104,000 tons of rock salt and 2,240,000 tons of salt made by evaporation. These figures show an increase of nearly 5 per cent over the quantity produced in 1922. The principal salt-producing states were: Michigan, 2,127,412 short tons; New York, 2,065,842 short tons, and Ohio, 1,102,387 short tons. Other large producers were Kansas, Louisiana and California.

Financial

A quarterly dividend of 2 per cent has been declared by the New Jersey Zinc Co. and will be payable on Nov. 10. An extra dividend of 2 per cent also has been declared, payable Oct. 10.

The U. S. Industrial Alcohol Co. has declared regular quarterly dividend of $1.75 on the preferred, payable Oct. 15.

The Fisk Rubber Co. reports net sales for 9 months ended July 31, $37,000,000 with operating profit after depreciation, but before interest and other charges of $2,595,000. Net profit after interest and other charges was $1,710,000.

The balance sheet of the Venezuelan Petroleum Co. as of July 31 shows total assets of $4,265,822, including acreage in Venezuela and royalties at $3,400,000.

A decision was handed down last Wednesday terminating the receivership suit against Wilson & Co. in the New Jersey courts.

The Howard Smith Paper Mills, Montreal, have passed the quarterly dividend of 1 per cent due at this time. The regular quarterly dividend of 2 per cent on preferred was declared.

Latest Quotations on Industrial Stocks

	Month Ago	This Week
Air Reduction	80	86½
Allied Chem. & Dye	74⅞	74⅝
Allied Chem. & Dye pfd	116	115½
Am. Ag. Chem	14½	12¼
Am. Ag. Chem. pfd	39¼	35¾
American Cyanamid	*101	*97
Am. Drug Synd	4⅝	5½
Am. Linseed Co	20¾	21⅜
Am. Linseed pfd	41	43⅜
Am. Smelting & Refining Co.	77¼	75⅛
Am. Smelting & Refining pfd.	104½	104
Archer-Daniels Mid. Co. w.i.	21	*20⅝
Archer-Daniels Mid. Co. pfd.	*87	*85⅝
Atlas Powder	51	50
Casein Co. of Am	*67	*67
Certain-Teed Products	28	38
Commercial Solvents "A"	64⅞	65⅛
Corn Products	32¼	35⅝
Corn Products pfd	*122	*122
Davison Chem.	44⅝	50½
Dow Chem. Co	*52	*52
Du Pont de Nemours	130½	131½
Du Pont de Nemours db	90	90⅞
Freeport-Texas Sulphur	8⅜	8¾
Gold Dust	39	*39
Grasselli Chem.	*125	*124
Grasselli Chem. pfd	*104	*103
Hercules Powder	95	*88
Hercules Powder pfd	103½	*104
Heyden Chem.	2⅝	3
Int'l Ag. Chem. Co. (new)	5½	6⅝
Int'l Ag. Chem. pfd. (ctfs.)	*37	*42
Int'l Nickel	18⅞	18¾
Int'l Nickel pfd	87	88
Int'l Salt	75⅞	*76½
Mathieson Alkali	40⅞	40
Merck & Co	65	63
National Lead	163	158⅝
National Lead pfd	117¼	117¾
New Jersey Zinc	163	*159
Parke, Davis & Co	*80	*80
Pennsylvania Salt	82½	*82½
Procter & Gamble	*109	*109
Sherwin-Williams	29	*30
Sherwin-Williams pfd.	*101	*101
Tenn. Copper & Chem	8⅞	7⅞
Texas Gulf Sulphur	78⅜	80¾
Union Carbide	60⅞	60¾
United Drug	83⅞	91⅛
United Dyewood	40	40
U. S. Industrial Alcohol	75⅞	72¼
U. S. Industrial Alcohol pfd.	*103	*105
Va.-Car. Chem. Co	1⅝	*1⅝
Va.-Car. Chem. pfd	5⅜	4⅝

*Nominal. Other quotations based on last sale.

German Air-Nitrogen Production Increased Since War

A survey of the nitrogen situation in European countries, prepared by the Department of Commerce as part of the investigation of essential raw materials authorized by the Sixty-seventh Congress, has just been issued. This report was made by Harry A. Curtis, of the Bureau of Foreign and Domestic Commerce, and Frank A. Ernst, of the Fixed Nitrogen Research Laboratory of the Department of Agriculture. A comprehensive review is made of the nitrogen situation in various countries of Europe.

In referring to the situation in Germany since the war, it is stated that in 1916 the Interessengemeinschaft was organized, including the older groups of interests together with several new members, particularly the Chemische Fabriken vorm. Weiler-ter-meer at Urdingen. In 1917 the Chemische Fabrick Griesheim-Elektron of Frankfurt joined the organization. This gigantic organization, usually referred to as the "I. G.," is the most extensive affiliation of interests ever developed. With this I. G. the various nitrogen-producing concerns are affiliated and the air-nitrogen industry in Germany must be considered as a part of a great interlocking system of interests which includes the whole German chemical industry and which is tied by financial interests to practically all of German industry.

At the end of the war the air-nitrogen industry in Germany was still undergoing expansion. The Piesteritz cyanamide plant was as yet unfinished and the Merseburg synthetic ammonia plant was in operation at part capacity. Both these plants were subsequently completed. The cyanamide plant which had been built at Chorzow, in Upper Silesia, went to Poland in the territorial adjustments following the war. The Gross-Kayna plant, after remaining idle a few years, was converted into a power plant. In 1920 the government's Piesteritz plant was transferred to the Mitteldeutschen Stickstoffwerke A. G.

The approximate production capacity of the air-nitrogen industry in Germany at present is given in the following statement:

	Metric Tons
By direct synthetic ammonia process:	
Badische Anilin- und Sodafabrik, Oppau	100,000
Ammoniawerke Merseburg, Merseburg	200,000
By cyanamide process:	
Mitteldeutsche Stickstoffwerke, Piesteritz	30,000
A. G. für Stickstoffdünger, Knapsack	12,000
Bayrische Stickstoffwerke, Trostberg, (Margaretenberg)	30,000
Lonzawerke, Waldshut	12,000
By arc process:	
Elektro-Nitrum A. G. Rhina	4,000
Elektrosalpeterwerke, Muldenstein	2,000
By coke and gas works: Combined capacity	100,000
Total fixed nitrogen	490,000

It should be pointed out here that since the production capacity for calcium carbide in Germany is considerably greater than corresponds to the cyanamide production capacity, it would be relatively easy for Germany to increase fixed nitrogen production by means of carbide if desirable. The drift of industry is in the other direction, however, for fixed nitrogen can be obtained more cheaply by the direct synthetic ammonia processes, whereas both carbide and cyanamide are finding more extensive use as the raw materials for manufacturing a variety of chemical products.

The actual production of fixed nitrogen in Germany is considerably less than the capacity production. Complete data are not available, but there may be assembled from various sources sufficient facts to make fairly accurate estimates of actual production for several postwar years in comparison with that of 1913. The data of the accompanying table are, therefore, tentative.

Production of Fixed Nitrogen in Germany

(In metric tons)

Produced from	1913	1920-21	1921-22	1922-23
Coal-gas and coke works	110,000	70,000	90,000	75,000
Cyanamide plants	5,000	50,000	47,000	35,000
Synthetic ammonia plants	7,000	110,000	170,000	210,000
Total fixed nitrogen	122,000	230,000	307,000	320,000

Trade Notes

R. R. Brown has been elected a director of the U. S. Industrial Alcohol Co., to succeed T. A. Howell.

James N. Gunn and Gordon Auchincloss have been appointed receivers in equity for the Hodgman Rubber Co., of Tuckahoe, N. Y.

H. D. Ruhm, of New York, last Wednesday was awarded a judgment of $12,500 against H. C. Ogden, of Wheeling, W. Va. Mr. Ruhn brought suit against Mr. Ogden in 1920 for breach of contract involving personal services and the case was heard last week in the United States District Court in New York.

Ralph Jennings, of the New York Quinine & Chemical Works, and John E. Falkingham, of Ellis Jackson & Co., have been elected members of the Chemical Salesmen's Association.

At the fiftieth annual convention of the National Wholesale Druggists Association, held last week in Atlantic City, Sewall D. Andrews, of Minneapolis, was elected president for the ensuing year. Other officers elected were: first vice-president, W. O. Kuebler, Newark; second vice-president, McKay Van Vleek, Memphis; third vice-president, W. F. Geary, Sacramento; fourth vice-president, George H. Suff, Columbus, Ohio; fifth vice-president, B. F. Page, Raleigh; secretary, C. H. Waterbury, New York; general representative, F. E. Holliday, New York.

William E. Vaughan, Jr., secretary to the U. S. trade commissioner at Johannesburg, reports that a plant for the production of arsenic has been erected at Breyton, South Africa, by the Union Collieries. It is reported that so far only experimental work has been undertaken.

Announcement is made that parts of Beardmore & Co.'s tannery, at Acton, Ont., Canada, which was recently destroyed by fire, will be rebuilt at once.

Men You Should Know About

Dr. Clifford E. Banta has left the Standard Oil Co. of Indiana to become chief chemist at the Frankford plant of The Barrett Co., Frankford, Pa.

E. B. Besselievre, of the Dorr Co., will speak before the Technology Club of Syracuse on the evening of Oct. 13, on modern methods of sewage disposal.

Mr. and Mrs. J. V. N. Dorr returned on the S.S. "Berengaria" recently from a 3 months visit in Europe.

Clyde H. Bailey, formerly professor of agricultural biochemistry, University of Minnesota, and director of the Minnesota State Experimental Flour Mill, has been granted a year's leave of absence from the university to become director of the technical bureau, Biscuit and Cracker Manufacturers Association, with headquarters in the Sharples Building, Chicago, Ill.

B. N. Broido, who has been doing special consulting work for the Superheater Co., of New York and Chicago, has recently been appointed chief engineer of the industrial department of the company.

J. M. Callow, president of the General Engineering Co., Salt Lake City, Utah, sailed Sept. 13 for a professional trip to Europe, to be absent about 2 months.

James A. Campbell, president of the Youngstown Sheet & Tube Co., Youngstown, Ohio, was a guest of honor Sept. 11 at a dinner given by prominent men in the steel industry at Cleveland, Ohio, on the occasion of his seventieth birthday.

John A. Campbell, president of the Trenton Potteries Co., Trenton, N. J., was a guest of honor at a meeting of the local Kiwanis Club, Sept. 17, at the Hotel Stacy-Trent. Mr. Campbell has just returned from a trip abroad.

Malcolm B. Catlin, Rutgers University, class of '24, has become a member of the faculty at the college, as instructor in the department of ceramics.

H. D. Cushman, president of the Ferro Enameling Co., Cleveland, Ohio, has established a graduate fellowship in chemistry at the Western Reserve University, Cleveland, Ohio, for the investigation of the gases dissolved in fused silicates.

Andrew M. Fairlie, consulting chemical engineer, of Atlanta, Ga., has been retained by the Armour Fertilizer Works as consulting engineer, for the erection of an eight-chamber sulphuric acid plant at Jacksonville, Fla., to replace the chambers recently destroyed by fire. Chambers of the Mills-Packard water-cooled type will be erected.

E. W. Fogel, superintendent at the plant of the Inland Glass Co., Chicago, Ill., since its beginning, has resigned.

John Gross, a metallurgist on the staff of the Bureau of Mines, who has been working on an investigation of milling practices at the Massachusetts Institute of Technology, has been transferred to the Salt Lake City station of the bureau, where he will work on ore-dressing problems.

R. E. Hannon has been appointed lubricating engineer for the General Petroleum Co., Los Angeles, Calif.

Dyke V. Keedy, consulting metallurgical engineer, of Melrose Highlands, Mass., is at present engaged in doing some exploration work in Cayenne, French Guiana.

E. E. Kimball, head of the Kimball Glass Co., Vineland, N. J., presided at the local Defense Day meeting, Sept. 12.

F. C. A. H. Lantsberry, managing director of William Jessop & Sons, Ltd., Sheffield, England, steel manufacturers, has arrived in New York on a business trip.

J. J. Morris has joined the staff of Law & Co., Inc., Atlanta, Ga., and Wilmington, N. C., consulting and analytical chemists, to assist Thomas B. Caldwell, who remains as manager and chief chemist of the Wilmington laboratory.

Herbert Pratt, of the American Cellulose & Chemical Manufacturing Co., New York, an expert on artificial silk, gave an address before the members of the Lehigh Valley Section of the American Chemical Society, Hotel Traylor, Sept. 19, dealing with the practical treatment and uses of artificial silk.

Sir Richard Threfall, of the chemistry and fuel board of the Scientific and Industrial Research Council of Great Britain, and Sir Frank Heath, secretary of the council, recently paid a visit to Ottawa.

George J. Whelan, of Cleveland, Ohio, has been elected president of the Kelley Island Lime & Transport Co., succeeding George R. Johnson, recently resigned. He has been with the company for the past 18 years, the last 5 years of which he has been vice-president and general manager. John A. Kling continues as chairman of the board of directors.

John Arthur Wilson, chief chemist of A. F. Gallun & Sons Co. and consulting chemist of the Sewerage Commission, Milwaukee, Wis., has recently returned from a trip to Europe.

Calendar

American Ceramic Society, Los Angeles, Calif., Oct. 6 to 7.

American Electrochemical Society, Detroit, Oct. 2 to 4.

American Foundrymen's Association, Milwaukee, Wis., Oct. 11 to 16, 1924.

American Gas Association, Steel Pier, Atlantic City, N. J., Oct. 13 to 17.

American Institute of Chemical Engineers, Hotel Shenley, Pittsburgh, Pa., Dec. 3 to 6.

American Institute of Electrical Engineers, Pasadena, Calif., Oct. 13 to 17.

American Institute of Mining and Metallurgical Engineers, Birmingham, Ala., Oct. 13 to 15.

American Society of Mechanical Engineers, New York, Dec. 1 to 4.

American Society of Refrigerating Engineers, New York, Dec. 1 to 3.

Association of Official Agricultural Chemists, Hotel Raleigh, Washington, D. C., Oct. 20 to 22.

Edward Hart Celebration and Intersectional Meeting of American Chemical Society, Easton, Pa., Oct. 16 to 18.

Management Week. Auspices of American Society of Mechanical Engineers, New York City, Oct. 20 to 25.

National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, Dec. 1 to 4.

Rensselaer Polytechnic Institute, Centennial Celebration, Troy, N. Y., Oct. 3 and 4.

Southern Exposition, Grand Central Palace, New York, Jan. 19 to 31, 1925.

Technical Association of the Pulp & Paper Industry, Hotel Statler, Buffalo, N. Y., Oct. 14 and 15.

Obituary

L. E. Z. Aronson, organizer of the Mid-Co Petroleum Co., operating in the Mid-Continent oilfields, Oklahoma, and at one time a leading independent organization in that district, died Sept. 11, in New York.

Mehren to Address Salesmen's Association

At a dinner of the Salesmen's Association of the American Chemical Industry to be held Tuesday, Sept. 30, at the Druachem Club, 15 John St., New York City, at 6 p.m., E. J. Mehren, vice-president of the McGraw-Hill Co., will speak on economic conditions in Europe. Mr. Mehren has just returned from an extended trip through England and Continental Europe and has gathered first-hand data of great economic value.

The dinner will be complimentary, but for members only. Results of the ballot for the election of officers for the coming year will be announced and the new officers will be installed. All members are urged to attend.

British Chemists Entertained

Washington chemists entertained at dinner Sept. 21 in honor of Prof. E. C. Bailey, of the University of Liverpool; Prof. F. G. Donan, of the University of London; Prof. J. F. Thorpe, of Imperial College, London; Sir Richard Threlfall, and Sir Robert Robertson, explosives chemist for Great Britain.

Prof. Fritz Haber, director of the Kaiser Wilhelm Institute of Physical Chemistry of Berlin, was in Washington on the day of the dinner and it was suggested that he be included among the guests. This raised determined protest from certain of the Washington chemists and no invitation was extended Professor Haber.

Market Conditions

Steadiness in Prices Features Market for Chemical Products

Basic Chemicals Holding Steady Price Level—Producers Slow to Name Prices for 1925 Deliveries

REPORTS from sellers of chemicals and allied products show that selling pressure has been materially removed and most of the important commodities are commanding full quotation values. The tendency to depart from private terms has been noted in recent weeks and continuance along that line is evidence of the improved call from consumers and the consequent reduction in stocks held by sellers. A few exceptions are still found where values are easy, especially where imported and domestic products are in keen competition.

The weighted index number for the week declined to 151.31 as compared with 151.83 for the preceding week. The lower level was due to unsettlement in some of the allied materials which offset the steady tone of the purely chemical commodities. The weighted index number a year ago was 172, which indicates a general price decline for the year, in excess of 12 per cent.

Trading in the spot market is confined to moderate sized lots but is holding up more consistently and total volume of sales for new account is reported to be gaining. Contract withdrawals likewise are more numerous. Reports from textile centers last week were encouraging. Some large textile mills established full time schedules and others increased their operating time. With the exception of window glass, demand for glass is reported as increasing and production is forging ahead. Some factories specializing in the manufacture of glass containers will resume operations this week. The paint and varnish trades are reported to be active and the rubber industry is increasing its output.

Last Monday an automatic decline in duty on coal-tars and dyes went into effect. This may have a bearing on the sale of domestic products, which will have greater competition from foreign markets. In this connection it is noted that government departments have asked domestic producers for reports on the volume of sales and this may forecast official recognition should foreign competition become excessive.

Acids

While price changes for mineral acids are infrequent the market for all selections has been firmer. This is indicated more by an adherence to the quoted prices than by higher quotations. During the summer months values were irregular inasmuch as sellers were open to bids from buyers and goods changed hands at private terms which usually represented substantial reductions from the figures openly quoted. As demand grew more active these price concessions were reduced in scope and the market has gradually worked to a point where sales are being made at the asking price level. It is a quiet period for tartaric and citric acids. Prices are not influenced much by the slowing up in consuming demand which may be accounted for by the fact that current quotations are as low as replacement costs will permit. Oxalic acid varies in price according to sellers and some holders are said to be looking for small lot business in order to obtain higher prices.

Domestic Arsenic Lower in Price — Copper Sulphate Easier — Barium Carbonate Advances — Metal Derivatives Less Firm — Epsom Salts Steady — Permanganate of Potash Irregular — Bleaching Powder and Liquid Chlorine Move Freely — Denatured Alcohol Firm at Recent Advance

Potashes

Caustic Potashes—Imported caustic has maintained a firm tone. Holders of spot material are reported to have refused bids under 6¾c. per lb. and the general quotation on spot is 6¾@7c. per lb. depending on seller. Foreign markets are steady and this is the main reason for present firmness in spot caustic. Shipments from abroad might be worked at 6⅝c. per lb. but 6¾c. per lb. is asked by the majority of importers.

Carbonate of Potash—Only small lot business has been passing and the lack of activity on the part of buyers has given an easy tone to market values. Sellers offer calcined 80-85 per cent at 5@5¼c. per lb. and 96-98 per cent at 5¾@6c. per lb. The hydrated is quoted at 5½c. per lb.

Permanganate of Potash—Quiet call from consumers has featured trading and prices have been irregular. Some holders of imported permanganate have been eager to unload and have been willing to grant concessions. Sales are reported to have gone through under 13c. per lb. General asking prices are 13@13¼c. per lb.

Prussiate of Potash—Consumers are not taking on round lots of yellow prussiate and the present differential is said to favor the soda product. Values for yellow prussiate of potash are holding steady in the face of the slow trading movement and spot holdings are maintained at 17c. per lb. Goods for prompt and nearby shipment from Europe are offered at 16½c. per lb.

Sodas

Bichromate of Soda—Second hands are not much of a factor and producers are reported to be in control of the market. Reports of sales under the quoted price levels have been current and have caused some doubt about the stability of prices. Some producers, however, say they are not looking for business at present quotations. Others openly quote 6⅝c. per lb. for carlots and 6¾@7c. per lb. represents the range.

Caustic Soda—This material is holding an even course with no new developments during the week. Domestic consumers continue to take deliveries against contracts and this is absorbing a good part of production. New contract prices are being awaited and in the meantime sellers quote 3.10c. per lb. for carload lots at works. Export buying has been light and prices heard f.a.s. range from 2.85c. to 3c. per lb. depending on seller and brand.

Nitrate of Soda—The spot supply of nitrate has been enlarged by recent arrivals from Chile and values have eased off as offerings gained in volume. Buyers are not in need of immediate stocks and trading has been quiet. Foreign markets are reported as showing very little interest in nitrate but primary markets are holding steady and there is no indication of any change in the price schedule as established for shipments over the remainder of the year. Quotations for spot nitrate are $2.45 per 100 lb. but this figure is easy and sales are said to have been made at concessions. It is unofficially stated that the State Department has received a reply from Chile with reference to its recent request for information about Chilean legislation which discriminated against American firms but nothing has yet been made public.

Nitrite of Soda—Prospects of higher prices for nitrite are said to have been lessened by recent developments, as imported material will continue to compete. Domestic nitrite is offered at 9@9¼c. per lb., at works, and imported is quoted at 9c. per lb. in the spot market.

Prussiate of Soda — Moderate sized

lots have been moving but demand is not active and prices have shown some irregularity. In most cases spot prussiate is quoted at 9¼c. per lb. but reports credit sales at 9c. and at 9⅛c. per lb. The market, therefore, is a matter of seller. Shipments of imported prussiate were offered at 8¾c. per lb.

Sulphide of Soda—Certain producers have attempted to stimulate trading by naming lower prices and the market now shows a price range according to seller. It is stated that 60 per cent fused has sold at 2¾c. per lb. f.o.b. producing works and broken at 3c. per lb., same basis. Crystals, single strength, are held at 1.80@2c. per lb.

Miscellaneous Chemicals

Arsenic — Some domestic producers who had been holding out for 7½c. per lb. were offering last week at 7¼c. per lb. Buyers are not interested in this material and some consumers are said to be carrying stocks which will take care of their requirements for some time. Imported arsenic is in a nominal position. Very little inquiry is heard and sellers admit that the general asking price of 7c. per lb. can be bettered and 6¾c. per lb. is regarded as a possible trading basis.

Barium Carbonate—The spot supply of imported barium carbonate has been reduced and holders were firmer in their views. Inquiry in the latter part of the week was met with quotations of $59@$60 per ton. The chloride was quiet and was easier with sellers at $73 per ton but there was a difference according to seller and up to $75 per ton was asked.

Bleaching Powder—Business consists largely in deliveries against standing orders with only moderate inquiry for spot material. Some interest has been shown in forward requirements but new contract prices have not been named. It is thought that no change will be made in the present contract level but there is nothing definite on that score. Current quotations are on a basis of 1.90c. per lb. for large drums, carlots at works. Liquid chlorine is moving freely at former prices of 4¾c. per lb., in tank cars.

Copper Sulphate—The metal has been easier in price and this has brought out lower selling prices for the sulphate. Some grades of domestic were offered last week at 4.45c. per lb. and asking prices ranged from that figure up to 4.85c. per lb. depending on seller and make. Imported sulphate for shipment was quoted at 4.25c. per lb.

Epsom Salts — While reports were current that imported grades sold at $1.35 per 100 lb. the general quotation gave $1.40 per 100 lb. as an inside figure and the market was reported as firm. Domestic grades were quoted at $1.80@$2 per 100 lb.

Sulphate of Ammonia—A good movement is reported to domestic consumers and producers are pretty well sold ahead. Prices are quoted at $2.60 per 100 lb. in bulk, f.o.b. works. Some inquiry was heard for export but offerings are very light and prices for export are little better than nominal.

Zinc Oxide—A moderate recession in zinc prices failed to affect sellers of oxide. New business was fair, from the standpoint of volume, and leading producers maintained the selling schedule on American process lead free at 7⅞c. per lb., carload lots. French process, red seal, was offered at 9⅝c. per lb.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	151.31
Last week	151.83
Sept., 1923	172.00
Sept., 1922	148.00
Sept., 1921	147.00
Sept., 1920	267.00
Sept. 1919	272.00
Sept., 1918	278.00

In the absence of any important price movement the weighted index number showed comparatively little change for the week. The moderate decline of 52 points reflected unsettlement in the vegetable oil group.

Alcohol

The market for denatured alcohol was firm at the recent advance. Producers reported a good volume of business and with a strong situation in basic materials the outlook favored sellers. On formula No. 5, completely denatured, the market stood at 49c. per gal., in drums, carload basis. Special denatured, formula No. 1, was offered at 50c. per gal., in drums.

Holdings of methanol have been reduced and this tends to steady prices. First hands, however, repeated the old schedule of prices, naming 76c. per gal., in bbl., on the 97 per cent grade.

Coal-Tar Products

Inquiry for Phenol Features Trading—Benzene Stocks Moderate and Prices Hold Steady—Intermediates in Better Demand

DEMAND for phenol was good and a firmer undertone was apparent in all quarters of the market. One of the leading producers refused to quote under 25c. per lb., in drums, on deliveries extending over the remainder of the year. There was more inquiry for intermediates, reflecting improved conditions in the textile industry. In crudes the situation underwent little change in the past week. Producers reported light holdings of benzene and rather steady prices, notwithstanding the recent weakness in the petroleum product. Solvent naphtha was offered more freely, but at unchanged prices. There was a fair call for naphthalene chips from intermediate makers, but the refined flake and balls were neglected. Foreign markets for crudes were inactive and prices irregular. Offerings of creosote oil were large at recently reduced prices. Foreign producers entertained firmer selling ideas on pyridine. Crude naphthalene was a shade firmer in the leading British markets.

Aniline Oil and Salt—There was a fair inquiry for aniline oil and with stocks moderate prices were firm in all quarters. First hands held out for 16c. per lb., in drums, carload basis, f.o.b. works. Aniline oil for red was nominal at 40c. per lb. The market for salt was unsettled, prices ranging from 20@22c. per lb., according to seller.

Benzene—Scarcely any change took place in the situation during the week. Production was about the same as in the preceding week, and, with stocks rather small, prices were steady, leading factors quoting on the basis of 23c. per gal. for the 90 per cent grade, and 25c. per gal. for the pure, tank cars, f.o.b. works.

Creosote—Domestic production being sold up, prices here were little more than nominal. Foreign markets remained unsettled. Manchester reported offerings in a fairly large way at 5½d. per gal., bulk basis, f.o.b. works. American buyers have been holding off.

Cresylic Acid — Some traders reported the market as firmer, but others continued to offer supplies on the old basis. Importations of crude have been smaller, due to the low position of the market on the domestic product. On the 97 per cent grade nominal quotations held at 63@68c. per gal., as to color, etc. Demand was routine only.

Naphthalene — Aside from a moderate increase in the call for chips the market for naphthalene was featureless. Intermediate makers have been taking on supplies in a larger way. Refined white flake was barely steady and prices of 4½@5c. were named during the week. Chips settled at 4@4¼c. per lb., carload basis, works. Crude was available for shipment at 2@2¼c. per lb.

Ortho-toluidine—Recent improvement in business resulted in a firmer undertone and some traders are asking slightly higher prices. The range of prices stood at 14@16c. per lb., according to seller.

Paranitraniline—Immediate shipment material was available at 68@70c. per lb., while on forward business it was intimated that 65c. might be done in some quarters.

Phenol—A fair amount of spot business was placed and prices steadied in all directions. Leading factors quote 25c. per lb., in drums, carload lots, all positions. One seller gave the range as unchanged at 24@25c. per lb., the inside figure applying on large drums. Offerings of prompt stuff were much smaller. First hands appear to be well sold up.

Pyridine — Several parcels arrived from abroad, but holders were firm in their ideas, based largely on the strength of the market abroad. Spot material held at $4.25@$4.50 per gal. British sellers quote 19s. 6d. per gal., f.o.b. point of production.

Solvent Naphtha—Competition with petroleum products tends to unsettle the market but leading factors continued to quote on the basis of 25c. per gal. on the water white, tank cars, f.o.b. works.

Vegetable Oils and Fats

Slow Consuming Demand for Refined Cottonseed Oil—China Wood Oil Advances—Crude Corn Oil Lower—Tallow Easy

COTTON crop estimates were less favorable, but as a market factor this news was offset by quiet conditions in refined oil and final prices were slightly lower for the week. Crude corn oil sold at a decline in price. There was good buying of domestic flaxseed and this supported values for linseed oil in the nearby positions. China wood oil advanced on scanty offerings from the Orient. Further weakness occurred in tallow, yet prices for palm oils held on an even basis, reflecting firm conditions abroad. Crude menhaden oil was strong.

Cottonseed Oil—The feature was the official report on the condition of the cotton crop. The Department of Agriculture estimated the crop at 12,596,000 bales, which compares with 12,787,000 bales on Sept. 1. For a time the reduction in the estimated output strengthened the market, but advances were not maintained because of rather indifferent trading in refined oil on the part of actual consumers. Prices eased later on unsettlement in crude. On the decline there was buying of nearby refined oil for refining interests, who, in turn, were sellers of futures. The monthly statistics on cottonseed products indicated consumption of refined oil during August of 157,000 bbl., which compares with 203,000 bbl. in August a year ago. While consumption was smaller than a year ago the visible supply at the close of the month was reduced to 216,000 bbl., as against 270,000 bbl. a year ago. Export inquiry was apparent again and it was reported that more than 2,500 bbl. sold during the week for shipment abroad. Prime summer yellow oil, September option, settled at 9.65c. bid and 9.90c. asked, with October at 9.75c. bid and 9.76c. asked. December refined oil closed on Thursday at 9.82c. bid and 9.84c. asked, cooperage basis. Crude oil for October shipment from the Southeast was offered at 8c. per lb., tank car basis, while in Texas there were sellers at 7¾c., same delivery. Prompt crude oil in the Southeast settled at 8c. bid and 8⅛c. asked., tanks, mills. Lard compound was quiet at 12½@13c. per lb. Pure lard in Chicago, settled at 13.65c. per lb.

Linseed Oil—Buying of oil was not active, yet prices held fairly steady covering all positions. The steadiness reflected slightly higher prices for domestic seed. Receipts of seed were larger, but the demand was brisk and good support was apparent on the soft spots. Crushers were anxious to accumulate stocks of seed for shipment to points East. Several shipments of domestic seed arrived at Eastern crushing centers during the week. Stocks of oil in the hands of producers remain small and this explains, to some extent, the premium obtaining for spot material. Immediate shipment oil was maintained at $1 per gal., carload lots, cooperage basis, while early October could have been purchased in several quarters at 95c. per gal. All October delivery oil was offered at 92@93c. per gal., cooperage basis, with November at 91c. per gal., and December forward at 89@90c. per gal. Prospects for a larger yield of seed in North America failed to weaken the ideas of holders of seed in the Argentine. The reports on the condition of the South American crop were conflicting, most of the news being unfavorable. A private estimate on the Canadian yield was issued during the week, placing the production at 7,595,370 bu. Trade authorities regarded this estimate as being more in line with conditions than the recent forecast made by the Dominion Bureau of Statistics. Cold weather prevailed in the Northwest, which did not help the crop.

Holdings of Cottonseed Oil in August Smaller

The visible supply of refined cottonseed oil on Aug. 31 amounted to 216,000 bbl., against a total of 270,000 bbl. on the corresponding date a year ago. Consumption of oil in August amounted to 157,000 bbl., which compares with 229,000 bbl. in July and 203,000 bbl. in August, 1923. Cottonseed and cottonseed products statistics for the month of August, with a comparison, follow:

	August	
	1924	1923
Seed received, ton	134,656	165,313
Seed crushed, ton	63,541	55,096
Crude oil mfd., lb.	17,922,241	15,182,320
Ref'd oil mfd., lb.	11,144,121	12,066,749
Stocks Aug. 31:		
Seed, ton	92,649	123,003
Crude oil, lb.	8,346,549	7,588,473
Refined oil, lb.	54,201,292	68,690,554
Exports Aug. 1 to 31:		
Crude oil, lb.	598,233	402,363
Refined oil, lb.	850,653	1,306,965
Cake and meal, ton	4,143	6,794

There was good export inquiry for linseed cake and the market ruled firm at $46 per ton bid and $47 per ton asked, f.a.s. New York. Flaxseed at Duluth closed at $2.29c. per bu., October option, and $2.25 per bu., December option. Buenos Aires quoted October seed at $2.03, with February nominal at $1.91 per bu.

China Wood Oil—With no change for the better in the Chinese situation the market for wood oil was strong. Spot oil in New York was raised to 16½c. per lb., in bbl., with October delivery at 16c. per lb., in bbl. On the Pacific coast prompt shipment oil in sellers' tank cars settled at 15c. per lb.

Corn Oil—Crude corn oil sold in Chicago at 8⅝c. per lb., tank cars, a decline of ⅜c. for the week. Refined oil on spot N. Y. settled at 11¾@12c., in bbl.

Coconut Oil—Not much business went over, but prices ruled steady, both here and on the Pacific coast. Locally the market for Ceylon type oil, immediate delivery, settled at 9¼c. per lb., tank car basis. San Francisco quoted prompt shipment oil at 8¾c. per lb., sellers' tank cars, and futures at 8⅝c. per lb., same terms.

Olive Oil Foots—There were sellers of prime green foots at 9½c. per lb., indicating that the market underwent no change.

Palm Oils—Cables were steady, despite the weakness in tallow. Lagos oil for shipment from Africa held at 8¾c. per lb. Niger oil for shipment from abroad settled at 7.70c. per lb., c.i.f. New York. Demand was quiet.

Rapeseed Oil—English makes of refined oil for future delivery were higher. First quarter 1925 delivery settled at 91½c. per gal. Spot refined oil sold at 88@89c. per gal.

Sesame Oil—Foreign markets were firm on reports that some sellers of Aug.-Sept. shipment refined oil were in default on deliveries. The market here was nominal at 12½@13½c. per lb., in bbl.

Soya Bean Oil—Crude oil, October shipment from the Pacific coast, nominal at 10@10¼c. per lb., sellers' tanks, duty paid.

Fish Oils—Crude menhaden oil was firm on unfavorable fishing returns and most sellers quote from 51½@52c. per gal., tank cars, factory. Recent business went through at 50c. Newfoundland tanked cod oil was firm at 63@65c. per gal.

Tallow, Etc.—Sales took place at 8⅛c. per lb. in city extra special tallow, a decline of ⅛c. Later goods equal to extra sold at 8c. per lb., ex plant. Yellow grease was lowered to 6¾@7c. per lb. Oleo stearine sold at 10¼c. per lb.

Miscellaneous Materials

Antimony—The market advanced ¼c. per lb., Chinese brands settling at 11¼@11½c. per lb. Demand was quiet, but sellers were shy because of the developments in China. Cookson's "C" grade was offered at 13@13¼c. per lb. Chinese needle, lump, nominal at 8½@9c. per lb. White oxide, Chinese, 99 per cent, 12@13c. per lb., an advance of ½c.

Fluorspar—F.o.b. Middle Western mines, per net ton: Gravel, not less than 80 per cent CaF_2 and not over 5 per cent SiO_2, $17.50. Gravel, not less than 85 per cent CaF_2 and not over 5 per cent SiO_2, $18.50. Lump, not less than 85 per cent CaF_2 and not over 5 per cent SiO_2, $18.50. Ground, 93 to 98.5 per cent CaF_2 and not over 3 per cent SiO_2, $35 in bulk, $39 in bags or barrels. Acid, ground, not less than 98½ per cent CaF_2 and not over 1 per cent SiO_2, $45 in bulk, $49 in packages.

Lithopone—New factors have been competing for business and this has resulted for some unsettlement in prices. Nominal quotations now range from 5¾@6c. per lb., in bags, carload lots, prompt and nearby delivery.

White Lead—There was a slightly easier market for the metal, but this had little influence upon traders in lead pigments. Corroders reported good business for this time of the year and prices held on the basis of 10c. per lb. for standard dry white lead, in bbl. or casks, carload lots.

Imports at the Port of New York

September 19 to September 25

ACIDS—Citric—100 kegs, Genoa, Superfos Co. **Formic**—50 csk. and 80 pkg., Rotterdam, Roessler & Hasslacher Chem. Co.; 149 demijohns, Rotterdam, R. W. Greeff & Co. **Tartaric**—100 kegs, Genoa, Superfos Co.; 50 csk., Rotterdam, W. Benkert & Co.

ALBUMEN—25 cs., Shanghai, Order; 89 cs., Shanghai, Order.

ALCOHOL — 325 bbl. and 25 dr. denatured, San Juan, C. Esteva.

ALUMINA SULPHATE—106 csk., Rottetrdam, Roessler & Hasslacher Chem. Co.

AMMONIUM OXALATE—10 csk., Antwerp, East River National Bank.

ANTIMONY—200 cs., Hankow, International Banking Corp., 194 cs., Hankow, Anglo South American Trust Co.; 785 bg. ore, Mollendo, Watson, Geach & Co.

AMMONIUM CARBONATE—15 bbl. and 3 cs., Liverpool, Brown Bros. & Co.

ASBESTOS — 1,334 bg., Beira, W. D. Crumpton & Co.

BARYTES — 600 bg., Rotterdam, E. L. Bullock & Sons.

BLEACHING POWDER—30 cs., Liverpool, H. Kohnstamm & Co.

BRONZE POWDER—14 cs., Bremen, L. Uhlfelder; 23 cs., Bremen, Gerstendorfer Bros.; 20 cs., Bremen, B. F. Drakenfeld & Co.

CALCIUM CHLORIDE—308 dr., Rotterdam, E. Suter & Co.

CALCIUM NITRATE—32 csk., Rotterdam, Kuttroff, Pickhardt & Co.

CASEIN—1,384 bg., Buenos Aires, National City Bank; 52 bg., Hamburg, Order; 1,667 bg., Buenos Aires, Bank of London & South America.

CHALK — 1,000 bg. ground, Antwerp, Cooper & Cooper; 300 bg., Antwerp, L. H. Butcher Co.; 400 bg., Antwerp, Brown Bros. & Co.; 500,000 kilos, Dunkirk, K. B. Fox; 800,000 kilos, Dunkirk, J. W. Higman Co.; 294,020 kilos, Dunkirk, Taintor Trading Co.; 900 bg., Antwerp, National City Bank; 445 bg., Antwerp, Downing & Co.

CHEMICALS—36 csk. and 40 cs., Rotterdam, Roessler & Hasslacher Chemical Co.; 250 csk., Rotterdam, H. Hinrichs Chemical Co.; 2 csk., Rotterdam, Kuttroff, Pickhardt & Co.; 113 csk., Rotterdam, H. Kastor; 250 bg., Rotterdam, P. Uhlich & Co.; 14 cs., Rotterdam, Magnus, Maybee & Reynard; 60 pkg., Rotterdam, Order; 20 cs., Hamburg, E. Dietzgen & Co.; 3 csk., Hamburg, J. C. Robold & Co.; 4 cs., Hamburg, S. B. Penick & Co.; 4 cs., London, Order.

CHROMIUM OXIDE—8 bbl., Rotterdam, Reichard-Coulston, Inc.

COLORS — 10 csk. dry, Southampton, Brown Bros. & Co.; 2 csk., Rotterdam, Sieman & Elting; 68 csk. alizarine, Rotterdam, Order; 5 csk. aniline, Rotterdam, Ciba Co.; 8 csk. earth, Rotterdam, Reichard-Coulston, Inc.; 17 cs. aniline, Havre, Wetterwald & Pfister; 13 csk. do., Antwerp, Geigy Co.; 15 pkg. aniline, Havre, Ciba Co.; 10 csk. do., Hamburg, Franklin Import & Export Co.; 20 csk. dry, Southampton, Sherwin, Williams & Co.

DEXTRINE—50 bg., Rotterdam, Order.

FERROTITANIUM — 3 csk., Liverpool, Order.

GALLNUTS—200 bg., Hankow, Order.

GLYCERINE — 29 dr. crude, Antwerp, Order; 109 csk. crude, Bordeaux, Order; 95 dr. do., Rio de Janeiro, Brazilian Mercantile Co.

GUMS — 140 bg. damar, Singapore, American Exchange National Bank; 100 cs. do. and 481 bg. do., Singapore, L. C. Gillespie & Sons; 50 cs. do. and 610 bg. do., Singapore, Baring Bros. & Co.; 100 cs. damar and 64 bg. copal, Singapore, L. C. Gillespie & Sons; 20 cs. do., Singapore, Brown Bros. & Co.; 178 pkg. copal and 250 cs. damar, Singapore, Order; 647 bg. copal, Antwerp, Order; 764 bg. copal, Matadi, L. C. Gillespie & Sons; 340 bg. copal, Antwerp, Order; 150 bg. arabic, Port Sudan, Thurston & Braidich; 50 bg. do., Port Sudan, Brown Bros. & Co.

IRON OXIDE — 92 bbl., Malaga, Reichard-Coulston, Inc.; 28 bbl., Malaga, L. H. Butcher Co.; 167 bbl., Malaga, Order; 37 csk., Liverpool, Reichard-Coulston, Inc.; 22 csk., Liverpool, Ford Motor Co.; 12 csk., Liverpool, L. H. Butcher & Co.; 20 cs., Liverpool, Stanley Doggett, Inc.

LITHOPONE — 80 csk., Rotterdam, Reichard-Coulston, Inc.; 40 csk., Rotterdam, E. L. Bullock & Sons; 100 csk., Antwerp, E. M. & F. Waldo.

LOGWOOD—204 tons, St. Marc, Stamford-Dyewood Co.; 190 bbl. extract, Cape Haitian, Logwood Mfg. Co.

MAGNESITE—10 bg. calcined, Genoa, Order; 313 bg. and 104 bbl., Rotterdam, Speiden, Whitfield Co.

MANGANESE ORE—959 bg., Antilla, H. S. Predmore.

MYROBALANS — 5,542 pkts., Calcutta, Order.

OCHER—67 bg., Calcutta, Order.

OILS—**China Wood**—300 csk., Hankow, W. R. Grace & Co.; 143 csk., Hankow, Irving Bank-Col. Trust Co.; 307 csk., Hankow, Standard Bank of South America; 660 tons (in bulk), Hankow, Order; 315 tons, Hankow (at San Francisco), Order. **Cottonseed**—35 dr. crude, San Juan, Porto Rican Produce Co. **Cod**—120 csk., Halifax, Cook & Swan. **Coconut**—649 tons (in bulk), Manila (at San Francisco), Order.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

CHEMICALS, heavy. Lubeck, Germany. Agency.—11,650.

DYE EXTRACTS. Santiago, Chile. Agency.—11,668.

GLUE. Buenos Aires, Argentina. Agency.—11,657.

LOGWOOD EXTRACT, in ton lots. Sydney, Australia. Purchase.—11,669.

PITCH. Rio de Janeiro, Brazil. Agency.—11,675.

SODA ASH, Bombay, India. Purchase and agency.—11,670.

SODA ASH. Rio De Janiero, Brazil. Agency.—11,675.

OILS, cottonseed, oleo and stock. Bergen, Norway. Agency.—11,701.

TALLOW AND FATS. Lubeck, Germany. Agency.—11,650.

Olive Foots (sulphur oil)—100 bbl., Bari, Brown Bros. & Co.; 100 bbl., Bari, Leghorn Trading Co.; 100 bbl., Bari, Order; 450 bbl., Patras, Order. **Palm**—35 csk., Antwerp, Order; 19 csk., Cotonau, Wile Corp.; 284 csk., Cotonau, Order; 941 csk., Grand Papo, Order; 132 csk., Liverpool, Palmolive Co. **Peanut**—50 bbl., Antwerp, Order. **Rapeseed**—100 bbl., Rotterdam, National City Bank; 20 bbl., Liverpool, Order. **Sesame**—60 bbl., Rotterdam, J. C. Francesconi & Co.; 96 bbl., Rotterdam, Rayner & Stonington, Inc.; 142 bbl., Antwerp, Order. **Soya Bean**—440 bbl., Rotterdam, National City Bank; 200 dr., Copenhagen, Order.

OIL SEEDS—**Castor**—35 bg., Jeremie, H. E. Botzow; 2,000 bg., Santos, Seaboard National Bank. **Copra**—375 bg., Port Antonio, Atlantic Navigation Co. **Linseed**—36,753 bg., Buenos Aires, L. Dreyfuss & Co.; 18,059 bg., Buenos Aires, Order; 37,399 bg., Buenos Aires, Order.

PITCH—28 bbl., Liverpool, Order.

PLUMBAGO—35 bbl., Colombo, Order.

POTASSIUM SALTS—1,250 bg. muriate, Bremen, Potash Importing Corp. of America; 63 csk. caustic, Bremen, Brown Bros. & Co.; 1,100 bg. nitrate, Rotterdam, Kuttroff, Pickhardt & Co.; 49 bbl. alum, Rotterdam, Hans Hinrichs Chem. Corp.; 42 dr. caustic, Rotterdam, American Exchange National Bank; 42 dr. caustic, Rotterdam, Order; 10 csk. metabisulphite, Hamburg, A. J. Marcus; 75 dr. caustic, Hamburg, Parsons & Petit.

PYRITES — 5,514,996 kilos, Huelva, Pyrites Co.

PUMICE—680 bg., Canneto Lipari, T. Van Amringe & Son; 4,788 bg. lump, Canneto Lipari, Gallagher & Ascher.

PYRIDINE—2 dr., Rotterdam, De Mattia Chemical Co.; 1 pkg., Manchester, Order.

QUEBRACHO—972 bg., Buenos Aires, Rose & English.

ROCHELLE SALTS—12 csk., Hamburg, A. J. Marcus.

ROSIN SOLUTION—19 csk., Hamburg, Franklin Import & Export Co.

SAL AMMONIAC—413 csk., Rotterdam, Kuttroff, Pickhardt & Co.; 39 csk., Hamburg, Order.

SHELLAC — 17 cs. sticklac, Singapore, Order; 100 bg. do., Singapore, International Banking Corp.; 15 cs., Rotterdam, C. F. Gerlach; 40 bg. garnet, Hamburg, Irving Bank-Col. Trust Co.; 75 bg., Calcutta, First National Bank of Boston; 300 bg., Calcutta, Bank of London & South America; 825 bg., Calcutta, Order; 136 bg., seedlac, Calcutta, Order.

SILVER SULPHIDE — 4 cs., Callao, Markt & Schaefer Co.

SODIUM SALTS—6,951 bg. nitrate, Antofagasta, Wessel Duval & Co.; 19,393 bg. do., Antofagasta, E. I. du Pont de Nemours & Co.; 21,207 bg. do., Iquique, Wessel, Duval & Co.; 14,436 bg. nitrate, Antofagasta, Wessel, Duval & Co.; 98 csk. phosphate, Rotterdam, Roessler & Hasslacher Chemical Co.; 110 csk. prussiate, Rotterdam, Order; 267 bbl. silico fluoride, Copenhagen, Order; 74 bbl. sulphate, Rotterdam, A. Klipstein & Co.; 150 csk. perborate, Rotterdam, International Acceptance Bank; 133 dr. sulphate, Rotterdam, C. S. Grant & Co.; 336 cs. cyanide, Havre, American-Hawaiian S.S. Co.; 168 cs. cyanide, Liverpool, Order.

STARCH—250 bg. potato, Rotterdam, Stein, Hall & Co.

STEARINE—75 cs. palm kernel, Copenhagen, Order.

SUMAC—140 bg. ground, Palermo, Irving Bank-Col. Trust Co.

TALC—500 bg., Genoa, Italian Discount & Trust Co.; 400 bg., Genoa, C. Mathieu; 1,000 bg., Genoa, Coty, Inc.; 350 bg., Genoa, L. A. Salomon & Bros.; 200 bg., Genoa, Hammill & Gillespie; 300 bg., Bordeaux, Order.

TALLOW—130 tcs., Vancouver, Order.

TARTAR — 164 bg., Buenos Aires, C. Pfizer & Co.; 34 csk., Leghorn, Royal Baking Powder Co.

WAXES—170 pkg. vegetable, Hamburg, Order; 50 bg. mineral, Hamburg, Order; 16 bg. beeswax, Catania, Order; 29 bg. beeswax, Azua, Mecke & Co.

WOOL GREASE — 200 bbl., Bremen, Pfaltz & Bauer; 100 bbl., Bremen, Bankers Trust Co.

ZINC CHLORIDE—44 csk., Antwerp, A. Klipstein & Co.

ZINC OXIDE—20 csk., Liverpool, L. H. Butcher Co.; 50 bbl., Marseilles, Reichard-Coulston, Inc.; 50 bbl., Marseilles, American Exchange National Bank; 100 bbl., Marseilles, Order.

Average Supply of China Wood Oil Expected

Consul-General Heintzleman reported by naval radio on Sept. 13 that a fair average supply of china wood oil is expected. Hankow stocks were estimated at 500 tons, with arrivals from the interior uncertain, due to unsettled political conditions. The prices during August ranged from a low of 18 taels per picul to a high of 20.50 taels, reached at the close of the month. August exports totaled 10,600,000 lb. of which 8,130,000 lb. was to the United States, as compared with 5,906,000 lb. and 5,378,000 lb., respectively, for July.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums, wks.	lb.	$0.16 –	$0.16½
Acetic anhydride, 85%, dr.	lb.	.34 –	.36
Acid, acetic, 28%, bbl.	100 lb.	3.12 –	3.37
Acetic, 56%, bbl.	100 lb.	5.85 –	6.10
Acetic, 80%, bbl.	100 lb.	8.19 –	8.44
Glacial, 99½%, bbl.	100 lb.	11.01 –	11.51
Boric, bbl.	lb.	.09 –	.09½
Citric, kegs	lb.	.45½ –	.47
Formic, 85%	lb.	.12 –	.12½
Gallic, tech.	lb.	.45½ –	.47
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.12½ –	.13
22% tech., light, bbl.	lb.	.06 –	.06½
Muriatic, 18° tanks	100 lb.	.80 –	.85
Muriatic, 20°, tanks	100 lb.	.95 –	1.00
Nitric, 36°, carboys	lb.	.04 –	.04½
Nitric, 42°, carboys	lb.	.04½ –	.05½
Oleum, 20%, tanks	ton	16.00 –	17.00
Oxalic, crystals, bbl.	lb.	.09½ –	.09¾
Phosphoric, 50% carboys	lb.	.07 –	.08
Pyrogallic, resublimed	lb.	1.55 –	1.60
Sulphuric, 60°, tanks	ton	8.00 –	9.00
Sulphuric, 60°, drums	ton	12.00 –	13.00
Sulphuric, 66°, tanks	ton	13.00 –	14.00
Sulphuric, 66°, drums	ton	17.00 –	18.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.26½ –	.28
Tartaric, domestic, bbl.	lb.	.29 –	.30
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.27 –	.30
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.86 –	.....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.84 –	.....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.56 –	.....
No. 1, 190 proof, special, dr.	gal.	.50 –	.....
No. 1, 188 proof, bbl.	gal.	.59 –	.....
No. 1, 188 proof, dr.	gal.	.53 –	.....
No. 5, 188 proof, bbl.	gal.	.55 –	.....
No. 5, 188 proof, dr.	gal.	.49 –	.....
Alum, ammonia, lump, bbl.	lb.	.03½ –	.04
Potash, lump, bbl.	lb.	.02¾ –	.03¼
Chrome, lump, potash, bbl.	lb.	.05½ –	.06
Aluminum sulphate, com., bags	100 lb.	1.35 –	1.40
Iron free bags	lb.	2.35 –	2.45
Aqua ammonia, 26°, drums	lb.	.06½ –	.06¾
Ammonia, anhydrous, cyl.	lb.	.28 –	.30
Ammonium carbonate, powd, tech., casks	lb.	.12½ –	.12¾
Ammonium nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	2.75 –	3.00
Antimony oxide, white, bbl.	lb.	.12 –	.13
Arsenic, white, powd., bbl.	lb.	.06½ –	.07¼
Arsenic, red, powd., kegs	lb.	.14½ –	.15
Barium carbonate, bbl.	ton	59.00 –	60.00
Barium chloride, bbl.	ton	73.00 –	80.00
Barium dioxide, 88%, drums	lb.	.17½ –	.18
Barium nitrate, casks		.07½ –	.08
Blanc fixe, dry, bbl.	lb.	.03½ –	.04
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 –	.....
Spot N. Y. drums	100 lb.	2.20 –	2.25
Borax, bbl.	lb.	.05 –	.05½
Bromine, cases	lb.	.34 –	.38
Calcium acetate, bags	100 lb.	3.00 –	3.05
Calcium arsenate, dr.	lb.	.08 –	.08½
Calcium carbide, drums	lb.	.05 –	.05½
Calcium chloride, fused, dr. wks.	ton	21.00 –	.....
Gran. drums works	ton	27.00 –	.....
Calcium phosphate, mono, bbl.	lb.	.06½ –	.07½
Camphor, Jap. cases	lb.	.68 –	.69
Carbon bisulphide, drums	lb.	.06 –	.06½
Carbon tetrachloride, drums	lb.	.06½ –	.07
Chalk, precip.—domestic, light, bbl.	lb.	.04½ –	.04¾
Domestic, heavy, bbl.	lb.	.03½ –	.04
Imported, light, bbl.	lb.	.04½ –	.05
Chlorine, liquid, tanks, wks.	lb.	.04½ –	.....
Contract, tanks, wks.	lb.	.04½ –	.....
Cylinders, 100 lb., wks.	lb.	.05½ –	.07½
Chloroform, tech., drums	lb.	.30 –	.32
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	15.00 –	16.00
Copper carbonate, bbl.	lb.	.17 –	.17½
Copper cyanide, drums	lb.	.45 –	.46
Copper oxide, kegs	lb.	.16½ –	.17
Coppersulphate, dom., bbl.	100 lb.	4.45 –	4.65
Imp. bbl.	100 lb.	4.25 –	4.35
Cream of tartar, bbl.	lb.	.20½ –	.21
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.35 –	1.40
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.10 –	2.35
Ether, U.S.P., dr concent'd.	lb.	.13 –	.14
Ethyl acetate, 85%, drums	gal.	.92 –	.95
Ethyl acetate, 99%, dr.	gal.	$1.08 –	$1.10
Formaldehyde, 40%, bbl.	lb.	.08¾ –	.09
Fullers earth—f.o.b. mines	ton	7.50 –	18.00
Furfural, works, bbl.	lb.	.25 –	.....
Fusel oil, ref., drums	gal.	3.50 –	3.75
Fusel oil, crude, drums	gal.	2.50 –	3.00
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.90 –	.92
Glycerine, c. p., drums extra.	lb.	.19 –	.19½
Glycerine, dynamite, drums	lb.	.18½ –	.18¾
Glycerine, crude 80%, loose	lb.	.12¼ –	.12½
Hexamethylene, drums	lb.	.65 –	.70
Lead:			
White basic carbonate, dry, casks	lb.	.10 –	.....
White, basic sulphate, casks	lb.	.09½ –	.....
White, in oil, kegs	lb.	.11¾ –	.11¾
Red, dry, casks	lb.	.11 –	.....
Red, in oil, kegs	lb.	.13¼ –	.13½
Lead acetate, white crys., bbl.	lb.	.14½ –	.....
Brown, broken, casks	lb.	.13½ –	.....
Lead arsenate, powd., bbl.	lb.	.16 –	.18
Lime-Hydrated, b.g., wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lime, Lump, bbl.	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10½ –	.....
Lithopone, bags	lb.	.06½ –	.06¾
Magnesium carb., tech., bags	lb.	.08¼ –	.08½
Methanol, 95%, bbl.	gal.	.74 –	.76
Methanol, 97%, bbl.	gal.	.76 –	.78
Methanol, pure, tanks	gal.	.75 –	.....
drums	gal.	.78 –	.80
bbl.	gal.	.83 –	.85
Methyl-acetone, t'ks.	gal.	.70 –	.....
Nickel salt, double, bbl.	lb.	.09 –	.10½
Nickel salts, single, bbl.	lb.	.10 –	.11
Orange mineral, csk.	lb.	.14 –	.14½
Phosgene	...	.60 –	.75
Phosphorus, red, cases	lb.	.70 –	.75
Phosphorus, yellow, cases	lb.	.37½ –	.40
Potassium bichromate, casks.	lb.	.08¼ –	.08¾
Potassium bromide, gran., bbl.	lb.	.28 –	.38
Potassium carbonate, 80-85%, calcined, casks	lb.	.05 –	.05½
Potassium chlorate, powd.	lb.	.06¾ –	.08¾
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.08½ –	.08¾
Potassium hydroxide (Caustic potash) drums	lb.	.06½ –	.....
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.06 –	.07½
Potassium permanganate, drums	lb.	.13 –	.13½
Potassium prussiate, red, casks	lb.	.37 –	.38
Potassium prussiate, yellow, casks	lb.	.17 –	.17½
Salammoniac, white, gran., casks, imported	lb.	.06½ –	.06½
Salammoniac, white, gran., bbl., domestic	lb.	.07½ –	.08
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20 –	1.40
Salt cake (bulk) works	ton	17.00 –	18.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 –	.....
bags, contract	100 lb.	1.38 –	.....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	.....
bags, contract	100 lb.	1.45 –	.....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	.....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f.a.s. N. Y.	100 lb.	2.85 –	3.05
Sodium acetate, works, bbl.	lb.	.04½ –	.05
Sodium bicarbonate, bulk	100 lb.	1.75 –	.....
330-lb. bbl.	100 lb.	2.00 –	.....
Sodium bichromate, casks	lb.	.06¾ –	.07
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½ –	.04¾
Sodium chlorate, kegs	lb.	.06¼ –	.06¾
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22
Sodium fluoride, bbl.	lb.	$0.08½ –	$0.09
Sodium hyposulphite, bbl.	lb.	.02½ –	.02¾
Sodium nitrate, casks	lb.	.09 –	.09½
Sodium peroxide, powd., cases	lb.	.23 –	.27
Sodium phosphate, dibasic, bbl.	lb.	.03½ –	.03¾
Sodium prussiate, yel. bbl.	lb.	.09½ –	.09¾
Sodium salicylic, drums	lb.	.38 –	.40
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.02¾ –	.03¼
Sodium sulphite, crys., bbl.	lb.	.02 –	.02¾
Strontium nitrate, powd., bbl	lb.	.09¾ –	.10
Sulphur chloride, yel drums	lb.	.04½ –	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08½
Tin bichloride, bbl.	lb.	.14¾ –	.....
Tin oxide, bbl.	lb.	.55 –	.....
Tin crystals, bbl.	lb.	.37 –	.....
Zinc carbonate, bags	lb.	.12 –	.14
Zinc chloride, gran, bbl.	lb.	.06 –	.07½
Zinc cyanide, drums	lb.	.36½ –	.37
Zinc dust, bbl.	lb.	.08 –	.08½
Zinc oxide, lead free, bag	lb.	.07¾ –	.....
5% lead sulphate bags	lb.	.06¾ –	.....
10 to 35% lead sulphate, bags	lb.	.06¾ –	.....
French, red seal, bags	lb.	.09¾ –	.....
French, green seal, bags	lb.	.10¾ –	.....
French, white seal, bbl.	lb.	.11¾ –	.....
Zinc sulphate, bbl.	100 lb.	3.00 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.62 –	$0.65
Alpha-naphthol, ref., bbl.	lb.	.65 –	.75
Alpha-naphthylamine, bbl.	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salt, bbl.	lb.	.19 –	.21
Anthracene, 80%, drums	lb.	.70 –	.75
Anthraquinone, 25%, paste, drums	lb.	.75 –	.80
Benzaldehyde U.S.P., carboys	lb.	1.50 –	.....
f.f.c. drums	lb.	1.60 –	.....
tech, drums	lb.	.68 –	.72
Benzene, pure, water-white, tanks, works	gal.	.25 –	.....
Benzene, 90%, tanks, works	gal.	.23 –	.....
Benzidine base, bbl.	lb.	.78 –	.80
Benzidine sulphate, bbl	lb.	.70 –	.72
Benzoic acid, U.S.P., kegs	lb.	.75 –	.85
Benzoate of soda, U.S.P., bbl.	lb.	.62 –	.65
Benzyl chloride, 95-97%, ref. carboys	lb.	.35 –	.....
Benzyl chloride, tech., drums.	lb.	.25 –	.....
Beta-naphthol, tech., bbl.	lb.	.24 –	.25
Beta-naphthylamine, tech.	lb.	.65 –	.70
Cresol, U.S.P., drums	lb.	.23 –	.26
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.63 –	.65
95-97%, drums, works	gal.	.58 –	.60
Dichlorbenzene, drums	lb.	.07 –	.08
Diethylaniline, drums	lb.	.59 –	.62
Dimethylaniline, drums	lb.	.35 –	.36
Dinitrobenzene, bbl.	lb.	.15 –	.17
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.18 –	.20
Dip oil, 25%, drums	gal.	.26 –	.28
Diphenylamine, bbl.	lb.	.48 –	.50
H-acid, bbl.	lb.	.72 –	.75
Meta-phenylenediamine, bbl.	lb.	.90 –	.95
Michlers ketone, bbl.	lb.	3.00 –	3.25
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	1.20 –	1.30½
Naphthalene, flake, bbl	lb.	.04½ –	.05
Naphthalene, balls, bbl.	lb.	.05 –	.05½
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.60 –	.62½
Nitrobenzene, drums	lb.	.09 –	.09
Nitro-naphthalene, bbl.	lb.	.25 –	.27
Nitro-toluene, drums	lb.	.13½ –	.14
N-W acid, bbl	lb.	1.00 –	1.05
Ortho-amidophenol, kegs	lb.	2.40 –	2.50
Ortho-dichlorbenzene, drums	lb.	.10 –	.12
Ortho-nitrophenol, bbl.	lb.	.95 –	1.00
Ortho-nitrotoluene, drums	lb.	.10 –	.11
Ortho-toluidine, bbl.	lb.	.14 –	.16
Para-aminophenol, base, kegs	lb.	1.15 –	1.20
Para-aminophenol, HCl, kegs	lb.	1.25 –	1.35
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Para-nitraniline, bbl	lb.	.68 –	.70
Para-nitrotoluene, bbl.	lb.	.50 –	.55
Para-phenylendiamine, bbl.	lb.	1.35 –	1.45
Para-toluidine, bbl.	lb.	.75 –	.80
Phthalic anhydride, bbl.	lb.	.25 –	.30
Phenol, U.S.P., dr.	lb.	.25 –	.26
Picric acid, bbl.	lb.	.20 –	.22
Pitch, tanks, works	ton	27.00 –	30.00
Pyridine, imp., drums	gal.	4.25 –	4.50
Resorcinol, tech., kegs	lb.	1 [illegible]	[illegible].40

Resorcinol, pure, kegs	lb.	$2.00 - $2.25
R-salt, bbl	lb.	.50 - .55
Salicylic acid, tech., bbl	lb.	.32 - .33
Salicylic acid, U.S.P., bbl	lb.	.35 - .....
Solvent naphtha, water-white, tanks	gal.	.24 - .25
Crude, tanks	gal.	.21 - .22
Sulphanilic acid, crude, bbl.	lb.	.16 - .18
Tolidine, bbl	lb.	1.00 - 1.05
Toluidine, mixed, kegs	lb.	.30 - .35
Toluene, tank cars, works	gal.	.26 - .....
Toluene, drums, works	gal.	.31 - .....
Xylidine, drums	lb.	.40 - .42
Xylene, 5 deg.-tanks	gal.	.38 - .40
Xylene, com., tanks	gal.	.25 - .27

Naval Stores

Rosin B-D, bbl	280 lb.	$6.05 - $6.15
Rosin E-I, bbl	280 lb.	6.25 - 6.35
Rosin K-N, bbl	280 lb.	6.35 - 6.45
Rosin W.G.-W.W., bbl	280 lb.	7.60 - 8.00
Wood rosin, bbl	280 lb.	5.40 - 5.50
Turpentine, spirits of, bbl	gal.	.87 - .87½
Wood, steam dist., bbl	gal.	.74 - .75
Wood, dest. dist., bbl	gal.	.55 - .56
Pine tar pitch, bbl	200 lb.	5.50 - .....
Tar, kiln burned, bbl	500 lb.	10.50 - .....
Retort tar, bbl	500 lb.	10.50 - .....
Rosin oil, first run, bbl	gal.	.40 - .....
Rosin oil, second run, bbl	gal.	.42 - .....
Rosin oil, third run, bbl	gal.	.46 - .....
Pine oil, steam dist	gal.	.60 - .....
Pine tar oil, com'l	gal.	.30 - .....

Animal Oils and Fats

Degras, bbl	lb.	$0.03¾ - $0.35½
Grease, yellow, loose	lb.	.06½ - .06¾
Lard oil, Extra No. 1, bbl	gal.	.84 - .85
Lard compound, bbl	lb.	.12½ - .13
Neatsfootoil, 20 deg. bbl	gal.	1.30 - .....
No. 1, bbl	gal.	.84 - .86
Oleo Stearine	...	.10½ - .10¾
Oleo oil, No. 1, bbl	lb.	.17½ - .....
Red oil, distilled, d.p. bbl	lb.	.09½ - .09¾
Saponified, bbl	lb.	.09½ - .09¾
Tallow, extra, loose works	lb.	.08¾ - .....
Tallow oil, acidless, bbl	gal.	.84 - .86

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.16½ - $0.06¾
Castor oil, No. 1, bbl	lb.	.16½ - .17
Chinawood oil, bbl	lb.	.16½ - .16¾
Coconut oil, Ceylon, bbl	lb.	.10½ - .10¾
Ceylon, tanks, N. Y.	lb.	.09½ - .09¾
Coconut oil, Cochin, bbl	lb.	.10½ - .10¾
Corn oil, crude, bbl	lb.	.10½ - .10¾
Crude, tanks, (f.o.b. mill)	lb.	.08½ - .....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08 - .08½
Summer yellow, bbl	lb.	.10½ - .10¾
Winter yellow, bbl	lb.	.12 - .12½
Linseed oil, raw, car lots, bbl.	gal.	1.00 - 1.02
Raw, tank cars (dom.)	gal.	.94 - .....
Boiled, cars, bbl. (dom.)	gal.	1.02 - 1.04
Olive oil, denatured, bbl	gal.	1.18 - 1.22
Sulphur, (foots) bbl	lb.	.09½ - .09¾
Palm, Lagos, casks	lb.	.08½ - .08¾
Niger, casks	lb.	.07½ - .08
Palm kernel, bbl	lb.	.09½ - .....
Peanut oil, crude, tanks (mill)	lb.	.12½ - .....
Peanut oil, refined, bbl	lb.	.16 - .16½
Perilla, bbl	lb.	.14 - .14½
Rapeseed oil, refined, bbl	gal.	.88 - .89
Sesame, bbl	lb.	.12½ - .12¾
Soya bean (Manchurian), bbl	lb.	.12 - .12½
Tank, f.o.b. Pacific Coast	lb.	.10½ - .....
Tank, (f.o.b. N. Y.)	lb.	.11 - .11½

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.63 - $0.65
Menhaden, light pressed, bbl.	gal.	.64 - .....
White bleached, bbl	gal.	.66 - .....
Blown, bbl	gal.	.68 - .....
Crude, tanks (f.o.b. factory)	gal.	.50 - .....
Whale No. 1 crude, tanks, coast	lb.	..... - .....
Winter, natural, bbl	gal.	.75 - .76
Winter, bleached, bbl	gal.	.78 - .79

Oil Cake and Meal

Coconut cake, bags	ton	$33.00 - $34.00
Cottonseed meal, f.o.b. mills	ton	36.00 - 38.00
Linseed cake, bags	ton	47.00 - .....
Linseed meal, bags, spot	ton	49.00 - 49.50

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.50 - $0.55
Albumen, egg, tech, kegs	lb.	.95 - .97
Cochineal, bags	lb.	.33 - .35
Cutch, Borneo, bales	lb.	.04½ - .04¾
Cutch, Rangoon, bales	lb.	.13½ - .14½
Dextrine, corn, bags	100 lb.	4.32 - 4.75
Dextrine, gum, bags	100 lb.	4.82 - 5.09
Divi-divi, bags	ton	41.00 - 42.00
Fustic, sticks	ton	30.00 - 35.00
Fustic, chips, bags	lb.	.04 - .05
Gambier com., bags	lb.	.14 - .14½
Logwood, sticks	ton	25.00 - 26.00
Logwood, chips, bags	lb.	.02½ - .03
Sumac, leaves, Sicily, bags	ton	165.00 - 170.00
Sumac, ground, bags	ton	160.00 - 165.00
Sumac, domestic, bags	ton	50.00 - 55.00
Starch, corn, bags	100 lb.	3.87 - 4.08
Tapioca flour, bags	lb.	.04½ - .06

Extracts

Archil, conc., bbl	lb.	$0.16 - $0.19
Chestnut, 25% tannin, tanks.	lb.	.01½ - .02½
Divi-divi, 25% tannin, bbl	lb.	.05 - .05
Fustic, crystals, bbl	lb.	.20 - .22
Fustic, liquid, 42°, bbl	lb.	.08 - .09½
Gambier, liq., 25% tannin, bbl.	lb.	.11 - .11
Hematine crys., bbl	lb.	.14 - .18
Hemlock, 25% tannin, bbl	lb.	.03½ - .04
Hypernic, solid, drums	lb.	.22 - .24
Hypernic, liquid, 51°, bbl	lb.	.12 - .13
Logwood, crys., bbl	lb.	.14 - .15
Logwood, liq., 51°, bbl	lb.	.07½ - .08½
Osage Orange, 51°, liquid, bbl.	lb.	.07 - .08
Osage Orange, powder, bg	lb.	.14 - .15
Quebracho, solid, 65% tannin, bbl	lb.	.04½ - .04¾
Sumac, dom., 51°, bbl	lb.	.06½ - .06¾

Dry Colors

Blacks-Carbongas, bags, f.o.b. works, contract	lb.	$0.09 - $0.11
spot, cases	lb.	.12 - .16
Lampblack, bbl	lb.	.12 - .40
Mineral, bulk	ton	35.00 - 45.00
Blues-Bronze, bbl	lb.	.37 - .38
Prussian, bbl	lb.	.37 - .38
Ultramarine, bbl	lb.	.07 - .35
Browns, Sienna, Ital., bbl	lb.	.05 - .12
Sienna, Domestic, bbl	lb.	.03 - .03½
Umber, Turkey, bbl	lb.	.04 - .04¼
Greens-Chrome, C.P.Light, bbl	lb.	.28 - .30
Chrome, commercial, bbl.	lb.	.10½ - .11½
Paris, bulk	lb.	.24 - .26
Reds, Carmine No. 40, tins	lb.	4.25 - 4.50
Iron oxide red, casks	lb.	.08 - .12
Para toner, kegs	lb.	.95 - 1.00
Vermilion, English, bbl	lb.	1.30 - 1.35
Yellow, Chrome, C.P. bbls	lb.	.17 - .17½
Ocher, French, casks	lb.	.02 - .03

Waxes

Bayberry, bbl	lb.	$0.21 - $0.21½
Beeswax, crude, Afr. bg	lb.	.26 - .26½
Beeswax, refined, light, bags.	lb.	.34 - .34
Beeswax, pure white, cases	lb.	.40 - .41
Candellila, bags	lb.	.25 - .26½
Carnauba, No. 1, bags	lb.	.34 - .36
No. 2, North Country, bags	lb.	.25½ - .26½
No. 3, North Country, bags	lb.	.22 - .23
Japan, cases	lb.	.16½ - .17
Montan, crude, bags	lb.	.06 - .06½
Paraffine, crude, match, 105-110 m.p., bbl	lb.	.06½ - .06¾
Crude, scale 124-126 m.p. bags	lb.	.05¼ - .05½
Ref., 118-120 m.p. bags	lb.	.05¾ - .06
Ref., 123-125 m.p., bags	lb.	.06 - .06¼
Ref., 128-130 m.p., bags	lb.	.06¼ - .06½
Ref., 133-135 m.p., bags	lb.	.07½ - .08
Ref., 135-137 m.p., bags	lb.	.10 - .10½
Stearic acid, sgle. pressed, bags	lb.	.11 - .11½
Double pressed, bags	lb.	.11½ - .12
Triple pressed, bags	lb.	.12½ - .13

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$7.50 - $7.75
Ammonium sulphate, bulk f.o.b. works	100 lb.	2.60 - .....
Blood, dried, bulk	unit	4.10 - 4.15
Bone, raw, 3 and 50, ground.	ton	26.00 - 28.00
Fish scrap, dom., dried, wks.	unit	4.75 - .....
Nitrate of soda, bags	100 lb.	2.45 - .....
Tankage, high grade, f.o.b. Chicago	unit	2.60 - 3.00
Phosphate rock, f.o.b. mines Florida pebble, 68-72%	ton	3.25 - 3.70
Tennessee, 75%	ton	6.75 - 7.00
Potassium muriate, 80%, bags	ton	34.55 - .....
Potassium sulphate, bags basis 90%	ton	45.85 - .....
Double manure salt, bgs	ton	26.35 - .....
Kainit, 14%, bgs	ton	10.25 - .....

Crude Rubber

Para—Upriver fine	lb.	$0.28 - .....
Upriver coarse	lb.	.18 - .....
Upriver caucho ball	lb.	.17½ - .....
Plantation—First latex crepe	lb.	.28½ - .....
Ribbed smoked sheets	lb.	.28 - .....
Amber crepe No. 1	lb.	.28 - .....

Gums

Copal, Congo, amber, bags	lb.	$0.08 - $0.10
East Indian, bold, bags	lb.	.13 - .14
Manila, amber, bags	lb.	.14 - .16
Pontinak, No. 1, bags	lb.	.19 - .20
Damar, Batavia, cases	lb.	.24½ - .25
Singapore, No. 1, cases	lb.	.27 - .28
Singapore, No. 2, cases	lb.	.18 - .18½
Kauri, No. 1, cases	lb.	.58 - .64
Ordinary chips, cases	lb.	.21 - .22
Manjak, Barbados, bags	lb.	.06 - .09

Shellac

Shellac, orange fine, bags	lb.	$0.64 - $0.65
Orange superfine, bags	lb.	.66 - .67
A. C. garnet, bags	lb.	.58 - .60
Bleached, bonedry	lb.	.73 - .74
Bleached, fresh	lb.	.62 - .....
T. N., bags	lb.	.62 - .....

Miscellaneous Materials

Asbestos, crude No. 1 f.o.b., Quebec	sh. ton	$300.00 - $350.00
Asbestos, shingle, f.o.b., Quebec	sh. ton	50.00 - 60.00
Asbestos, cement, f.o.b., Quebec	sh. ton	15.00 - 20.00
Barytes, grd., white, f.o.b. mills, bbl	net ton	16.00 - 17.00
Barytes, grd., off-color, f.o.b., Balt	net ton	13.00 - 14.00
Barytes, floated, f.o.b., St. Louis, bbl	net ton	23.00 - 24.00
Barytes, crude f.o.b. mines, bulk	net ton	8.00 - 9.00
Casein, bbl., tech	lb	.10½ - .12
China clay (kaolin) crude, No. 1, f.o.b. Ga	net ton	7.00 - 8.00
Washed, f.o.b. Ga	net ton	8.50 - 9.00
Powd., f.o.b. Ga	net ton	14.00 - 20.00
Crude, f.o.b. Va	net ton	6.00 - 8.00
Ground, f.o.b. Va	net ton	13.00 - 19.00
Imp., lump, bulk	net ton	15.00 - 20.00
Imp., powd	net ton	45.00 - 50.00
Feldspar, No. 1 f.o.b. N.C.	long ton	6.50 - 7.25
No. 2 f.o.b. N.C.	long ton	4.50 - 5.00
No. 1 gr'd. N.C.	long ton	15.32 - 21.00
No. 1 Canadian, f.o.b., mill, powd	long ton	20.00 - .....
Graphite, Ceylon, lump, first quality, bbl	lb.	.05½ - .06
Ceylon, chip, bbl	lb.	.04½ - .05
High grade amorphous crude	ton	15.00 - 35.00
Gum arabic, amber, sorts, bags	lb.	.12 - .12
Gum tragacanth, sorts, bags.	lb.	.50 - .55
No. 1, bags	lb.	1.20 - .....
Kieselguhr, f.o.b. Cal	ton	40.00 - 42.00
F.o.b. N.Y.	ton	50.00 - 55.00
Magnesite, calcined, f.o.b.Cal.	ton	35.00 - 45.00
Pumice stone, imp., casks	lb.	.03 - .40
Dom., lump, bbl	lb.	.06 - .08
Dom., ground, bbl	lb.	.03 - .05
Silica, glass sand, f.o.b. Ind.	ton	2.00 - 2.25
Silica, sand blast, f.o.b.Ind.	ton	2.25 - 3.50
Silica, amorphous, 200-mesh, f.o.b. Ill.	ton	20.00 - .....
Silica, glass sand, f.o.b. Ill.	ton	2.00 - 2.50
Soapstone, coarse, f.o.b., Vt., bags	ton	7.50 - 8.00
Talc. 200 mesh, f.o.b., Vt., bags, extra	ton	10.50 - .....
Talc. 200 mesh, f.o.b., Ga., bags	ton	9.50 - 10.00
Talc, 325 mesh, f.o.b. New York, grade A bags	ton	14.75 - .....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$2.75 - $3.00
Corning	bbl.	1.75 - .....
Cabell	bbl.	1.45 - .....
Somerset	bbl.	1.55 - .....
Illinois	bbl.	1.62 - .....
Indiana	bbl.	1.63 - .....
Kansas and Okla. under 28 deg.	bbl.	.85 - .....
California, 35 deg. and up	bbl.	1.40 - .....

Gasoline, Etc.

Motor gasoline steel bbls	gal.	$0.17 - .....
Naphtha, V. M. & P. deod, steel bbls	gal.	.16 - .....
Kerosene, ref. tank wagon	gal.	.13 - .....
Bulk, W.W. delivered, N.Y.	gal.	.08½ - .....
Lubricating oils:		
Cylinder, Penn., filtered	gal.	.29 - .32
Bloomless, 30@31 grav	gal.	.20 - .21
Paraffin, pale 885 vis	gal.	.15½ - .16½
Spindle, 200, pale	gal.	.21 - .21½
Petrolatum, amber, bbls	lb.	.04 - .04½
Paraffine wax (see waxes)		

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140-$145
Chrome brick, f.o.b. Eastern shipping points	ton	45-47
Chrome cement, 40-50% Cr_2O_3	ton	23-27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks	1,000	40-43
2nd. quality, 9-in. shapes, f.o.b. wks	1,000	33-37
Magnesite brick, 9-in. straight (f.o.b. wks)	ton	65-68
9-in. arches, wedges and keys	ton	80-85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48-50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48-50
F.o.b. Mt. Union, Pa.	1,000	35-38
Silicon carbide refract brick, 9-in.	1,000	1,180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N. Y.	ton	$200.00 - .....

Ferrochromium, per lb. of Cr, 1-2% C	lb.	\$0.30 – ..
4-6% C	lb.	.12½ – ..
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	95.00 – ......
Spiegeleisen, 19-21% Mn.	gr. ton	33.00 – \$35.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00 – 2.25
Ferrosilicon, 10-12%	gr. ton	39.50 – 43.50
50%	gr. ton	72.00 – 75.00
Ferrotungsten, 70-80% per lb. of W	lb.	.88 – .90
Ferro-uranium, 35-50%, of U, per lb. of U	lb.	4.50 – ......
Ferrovanadium, 30-40%, per lb. of V	lb.	3.25 – 3.75

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	\$5.50 – \$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 – ......
C.i.f. Atlantic seaboard	ton	19.00 – 24.00
Coke, fdry., f.o.b. ovens	ton	4.00 – 4.50
Coke, furnace, f.o.b. ovens	ton	3.00 – 3.10
Fluorspar, gravel, f.o.b. mines, Illinois	ton	17.50 – 18.50
Ilmenite, 52% TiO_2 Va.	lb.	.01½ – .....
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.41 – .45
Manganese ore, chemical (MnO_2)	ton	75.00 – 80.00
Molybdenite 85% MoS_2, per lb. Mo S_2, N. Y.	lb.	.70 – ....
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 – .08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½ – .12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.12 – .....
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 – .....
Rutile, 94@96% TiO_2	lb.	.12 – .15
Tungsten, scheelite, 60% WO_3 and over	unit	9.00 – .....
Tungsten, wolframite, white, 60% WO_3	unit	8.50 – 8.75
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 – 3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 – 12.50
Vanadium pent oxide, 99%	lb.	12.50 – 14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 – 1.25
Zircon, 99%	lb.	.06 – .07

Non-Ferrous Metals

Copper, electrolytic	lb.	\$0.13 – \$0.13½
Aluminum, 98 to 99%	lb.	.27 – .28
Antimony, wholesale, Chinese and Japanese	lb.	.11¼ – .11½
Nickel, 99%	lb.	.27½ – .29
Monel metal, shot and blocks	lb.	.32
Tin, 5-ton lots, Straits	lb.	.47½
Lead, New York, spot	lb.	.08
Lead, E. St. Louis, spot	lb.	.07825
Zinc, spot, New York	lb.	.0645
Zinc, spot, E. St. Louis	lb.	.0610
Silver (commercial)	oz.	.69¾
Cadmium	lb.	.60
Bismuth (508 lb. lots.)	lb.	1.85–1.90
Cobalt	lb.	2.50–3.00
Magnesium, ingots, 99%	lb.	.90–95
Platinum, refined	oz.	118.00
Iridium	oz.	260.00–270.00
Palladium, refined	oz.	80.00
Mercury	75 lb.	72.00
Tungsten powder	lb.	.95–1.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	20.62½
Copper bottoms	29.75
Copper rods	20.00
High brass rods	17.25
High brass rods	14.75
Low brass wire	19.50
Low brass rods	20.00
Brazed bronze tubing	24.75
Seamless copper tubing	22.75
Seamless high brass tubing	21.50

OLD METALS—The following are the dealers purchasing prices in cents per pound:

Copper, heavy and crucible	10.50 @ 11.75
Copper, heavy and wire	11.00 @ 11.25
Copper, light and bottoms	9.50 @ ......
Lead, heavy	6.50 @ 6.75
Lead, tea	5.00 @ 5.25
Brass, heavy	6.50 @ ....
Brass, light	5.50 @ ....
No. 1 yellow brass turnings	7.00 @ 7.25
Zinc scrap	3.75 @ 4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	\$3.34	\$3.34
Soft steel bars	3.24	3.24
Soft steel bar shapes	3.54	3.54
Soft steel bands	3.99	3.99
Plates, ¼ to 1 in. thick	3.34	3.34

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

BIRMINGHAM—The Standard Gas Products Co. of Alabama, Inc., operating a new local plant for the manufacture of commercial oxygen, has tentative plans under consideration for the erection of a 1-story addition, to be equipped for the production of acetylene and kindred products. It is said that the extension will cost in excess of \$100,000, with machinery, and will double, approximately, the plant capacity. P. W. Wilcox is manager.

California

MODESTO—The D. V. O. Co., recently organized, has acquired the local plant of the California Sorghum & Syrup Co. The entire works will be remodeled and improved by the new owner and considerable additional equipment installed for the manufacture of fertilizer products, insecticides, lime and barium specialties, as well as sugar sirups. It is purposed to have the enlarged plant ready for service early in the coming year. The new company is headed by Norman De Vaux, president of the Star Motor Co. of California; Alexander Boonington, chemical engineer; and C. E. Gilman, mining engineer.

TUJUNGA — The Consolidated Minerals Corp. has acquired a tract of property in the Little Tujunga Canyon and has preliminary plans under advisement for the construction of a new cement mill and lime manufacturing plant, reported to cost in excess of \$350,000, with machinery. The company also purposes to build an addition to its present silica mill, and install additional equipment. Frank J. Buck is production manager in charge.

OAKLAND—The Pacific Lock Joint Pipe Co., Seattle, Wash., has purchased property total about 5 acres at the foot of 87th St., vicinity of G St., and plans to use a portion of the site for the early erection of a new branch plant for the manufacture of concrete pipe, culverts, and kindred products. The initial works are expected to cost about \$50,000.

MONTEREY—The Associated Oil Co. and the Standard Oil Co. of California, Inc., have preliminary plans under advisement for the rebuilding of the portions of their local storage and distributing plants, occupying neighboring sites, destroyed by fire, Sept. 15, with loss reported in excess of \$750,000, including equipment.

Delaware

WILMINGTON—Fire, Sept. 14, destroyed a portion of the plant of Barr & Daugherty, Inc., Elsmere, Wilmington, operating a hide, tallow and grease works, with loss estimated in excess of \$200,000, including equipment and stock. Plans for rebuilding are under consideration.

Florida

TAMPA—The Imperial Petroleum Corp. is perfecting plans for the early erection of a new storage and distributing plant on site selected in the Hooker's Point section, estimated to cost close to \$200,000, with machinery.

Georgia

DUBLIN — The Consolidated Phosphate Co. has tentative plans under advisement for the rebuilding of the portion of its local plant recently destroyed by fire. An official estimate of loss has not been announced.

Illinois

CHICAGO—The J. A. Steen Varnish Co., Shields Ave. and 37th St., has filed plans for the erection of a 1-story addition, to be equipped for general manufacturing, for which a general contract recently was let to the Sumner Sollitt Co., 225 North Michigan Ave. G. C. Nimmons, 122 South Michigan Ave., is architect.

CHICAGO—The Martin Varnish Co., 2520 Quarry St., is asking bids on a general contract for the erection of a new 3-story and basement plant, 50x85 ft., at Peoria St. and 49th Pl., estimated to cost close to \$50,000. J. E. O. Pridmore, 38 South Dearborn St., is architect. Z. E. Martin is president and treasurer.

Indiana

NOBLESVILLE—The Jenkins Glass Co. is planning for the rebuilding of the portion of its plant destroyed by fire, Sept. 15, with loss estimated at \$27,000, including equipment. The works have been giving employment to about 500 persons.

Kentucky

MARION—The Lafayette Fluorspar Co. has preliminary plans under way for the construction of a new mining and milling plant on local site for commercial fluorspar production, consisting of several 1-story buildins, with power house and auxiliary structures, estimated to cost close to \$100,000, with machinery. T. J. Muller, Mexico, Ky., is construction engineer, in charge.

Maryland

BALTIMORE—The Menasha Printing & Carton Co., Menasha, Wis., manufacturer of waxed paper wrappers, paraffined cartons, pails, etc., has perfected plans for the establishment of a new branch plant at Baltimore and plans for the early installation of equipment in a local building. The company will continue in operation its present plants at Menasha and Wausau, Wis. To carry out expansion plans, a bond issue of \$1,000,000 is being sold. G. S. Gaylord is president and general manager.

CUMBERLAND—The West Virginia & Maryland Gas Co. has tentative plans under advisement for the construction of a new local artificial gas plant, to supplement its natural gas supply, estimated to cost approximately \$500,000, with equipment. It is understood that the project will be carried out in conjunction with the Southern Gas & Power Co., operating at Bluefield, W. Va., and vicinity.

Michigan

DETROIT—The Howard Flint Ink Co., Inc., 1424 Sherman St., will commence excavations for its proposed new 2-story and basement plant, 100x230 ft., at Scotten Ave. and the line of the Michigan Central R.R., for which a general contract recently was awarded to the Otto Misch Co., 159 East Columbia St. It is estimated to cost in excess of \$60,000. Weston & Ellington, Stroh Bldg., are architects and engineers.

Missouri

PACIFIC—The Pioneer Silica Products Co., Inc., 68 De Menil Bldg., St. Louis, Mo., has plans under way for the establishment of a local mill on a 20-acre tract of land. Complete drying, grinding, sorting and other equipment will be installed for commercial production, and contracts are being placed for equipment. Mining machinery will also be installed for raw material supply. The entire project is estimated to cost close to \$55,000. C. R. Meier is secretary and treasurer.

ST. LOUIS—The American Stove Co., 825 Chouteau St., has completed plans for the erection of a two-story experimental and research laboratory for metallurgical and other work, to be 50x80 ft., located on Daggett Ave., estimated to cost about \$30,000. E. C. Panssen, Chemical Bldg., is architect.

SPRINGFIELD—The Tulsa Oxygen Co., Tulsa, Okla., is said to have tentative plans under advisement for the establishment of a branch plant on local site for the manufacture of commercial oxygen and affiliated products, estimated to cost \$130,000, with equipment. Charles P. Harter is plant superintendent, in charge.

FREISTATT—The Lime Phosphate Co., F. W. Voelpel, Aurora, Mo., secretary, recently chartered, has acquired a local tract of about 1,000 acres of phosphate property, and plans for the installation of a plant for development for commercial production. The initial expenditure for buildings and equipment is reported to approximate \$50,000. L. E. Brougher is president.

New Jersey

Delawanna—The Minwax Co., Inc., manufacturer of waterproofing compounds for building service, etc., is considering plans for the reconstruction of the portion of its plant destroyed by fire, Sept. 13, with loss estimated at $25,000, including equipment.

New York

Buffalo—The Pennzoil Co., Inc., Main St., has applied to the City Council for permission to build a new oil storage and distributing plant on a tract of land near Skillen St., to replace its works recently destroyed by fire with loss reported at close to $150,000. The new plant will consist of a number of buildings and will include a compounding works for lubricating oils. A. S. Mattheus is vice-president and general manager.

New York—Plans are being prepared by McKim, Mead & White, 101 Park Ave., architects, for the proposed 12-story chemistry and physics building to be erected at Broadway and 120th St., for Columbia University. It will be 62x182 ft. with cost figured at close to $1,000,000. Bids are expected to be asked in the near future.

North Carolina

Wilmington—The Standard Oil Co. is reported to be perfecting plans for the rebuilding of the portion of its local oil storage and distributing plant, recently destroyed by fire with loss approximating $175,000, including equipment.

Ohio

East Liverpool—Officials of the East Liverpool Potteries Co., Wellsville, O., manufacturer of chinaware, have purchased a controlling interest in the pottery of the Cartwright Brothers Co., foot of Market St., East Liverpool, devoted to a similar line of production. The new owners will take immediate possession, and are said to have plans under consideration for extensions and improvements. The plant will be operated in conjunction with the Wellsville pottery, giving the company a total of fourteen kilns. Bernard Purinton, W. E. Brown and L. R. DeMunn are heads.

Oklahoma

Sand Springs—The Pierce Petroleum Corp., National Bank of Commerce Bldg., Tulsa, Okla., is reported to have arranged a fund in excess of $1,000,000, for extensions and improvements in its local refining plant, recently placed under way, to include the erection of additional buildings and the installation of considerable refining and byproducts equipment.

Oregon

Portland—The Select Chemical Co. has preliminary plans under consideration for the erection of a new 3-story plant in the Multnomah district, estimated to cost approximately $45,000, with equipment.

West Linn — The Crown - Willamette Paper Co. contemplates the construction of an addition to its paper and pulp mills for considerable increase in output. J. C. Tindsley is superintendent of construction for the company and will be in charge of the work.

Pennsylvania

Philadelphia—The Philadelphia Paper Mfg. Co., Nixon and Fountain Sts., has awarded a general contract to the Hughes-Foulkrod Co., Commonwealth Bldg., for the erection of a 1-story addition to its mill, estimated to cost $25,000, for which work will proceed at once. John Jacobs, Jr., is president.

Philadelphia—Charles Eneu Johnson & Co., Lombard and 10th Sts., manufacturer of printing inks, has awarded a contract to F. L. Hoover & Son, 1023 Cherry St., for the erection of a new addition to its plant at location noted, estimated to cost $50,000. The Ballinger Co., 12th and Chestnut Sts., is architect and engineer.

Philadelphia—The Consolidated Ethyl Solvents Co., State Rd. and American St., has plans for the erection of a 1-story building at its plant at State Rd. and Robbins St., on which work will be placed in progress immediately. Plans have been filed.

Salina—The Kier Fire Brick Co., Oliver Bldg., Pittsburgh, has awarded a general contract to the H. K. Ferguson Co., Euclid Ave., Cleveland, O., for the erection of an addition to its firebrick and refractory manufacturing plant here, 1-story, 50x150 ft., estimated to cost $50,000. The contractor is also acting as architect for the work.

Texas

Lubbock—The Lubbock Cotton Oil Co. has completed plans and will begin the immediate construction of a new cottonseed oil mill on local site, 1-story, estimated to cost approximately $65,000, with equipment. A contract for the building has been let to J. W. Neves, Lubbock.

Sugarland—The Imperial Sugar Co., Inc., recently organized with a capital of $5,000,000, is arranging to take over the local sugar refinery of the Sugarland Industries, Inc. Plans are under way for extensive additions and improvements for large increase in capacity, estimated to cost in excess of $1,500,000, with machinery. The new organization is headed by G. D. Ulrich and W. T. Eldridge, Jr., both of Sugarland.

Waco—The Industrial Cotton Oil Co., Mary and First Sts., has preliminary plans under advisement for the rebuilding of the portion of its cottonseed oil mill, recently destroyed by fire with loss estimated at $25,000.

Washington

Tumwater—The West Coast Pulp & Paper Co., Inc., Olympia, Wash., recently organized with a capital of $1,250,000, has preliminary plans under way for the construction of a new pulp and paper mill at Tumwater, near Olympia, to consist of several 1-story units, with power house, machine shop and miscellaneous structures, estimated to cost approximately $650,000, with equipment. The new company is headed by John H. McNary and H. S. Gile, both of Olympia.

Wisconsin

Eau Claire—The Dells Paper & Pulp Co. plans for the rebuilding of the portion of its pulpwood and conveyor building destroyed by fire, Sept. 12, with loss estimated at $30,000.

New Companies

Malone Brothers Co., Chelsea, Mass.; paper and paperboard products; $50,000. Charles A. Malone, 11 Lafayette Ave., Chelsea, is president and treasurer.

Weatherford Cotton Oil Co., Weatherford, Tex.; cottonseed oil products; $75,000. Incorporators: J. D. Clinton, P. R. Draselton and P. A. Clifton, all of Weatherford.

Da'Lav Chemical Co., Inc., Newark, N. J.; chemicals and chemical compounds; $50,000. Incorporators: David Levin and David Weineck. Representative: William Krueger, 207 Market St., Newark.

Union Rendering Co., Inc., 2601 West Franklin St., Baltimore, Md.; grease, tallow, oils, etc.; $25,000. Incorporators: Samuel J., Allan H. and Morton P. Fisher.

Moosehead Paper Co., Skowhegan, Me.; paper and pulp products; $300,000. David Albert Chapman, Boston, Mass., is president; and John J. Moore, Boston, treasurer.

Smith-Ulrich Co., Buffalo, N. Y.; paints, varnishes, etc.; $10,000. Incorporators: F. E. M. and L. C. Smith, and M. A. Ulrich. Representative: Merritt N. Baker, Peoples Bank Bldg., Buffalo.

Swastika Oil & Refining Co., Olney, Tex.; refind petrolum products; capital not stated. Incorporators: G. O. Cozart, C. I. Weldon and N. D. Goldsmith, all of Olney.

Whaleback Liquid Roofing Co., Miami, Fla.; compounds for roofing and waterproofing service; $20,000. Incorporators: R. C. Belgau and John M. Ryan, both of Miami. The first noted will be president.

Consolidated Clay Corp., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative; pottery, tile and other burned clay products; $10,000,000.

Sellin Mfg. Corp., Jersey City, N. J.; steel products; $50,000. Incorporators: William E. Russell, Townsend Baker and John H. Heflin, 108 Academy St., Jersey City. The last noted is representative.

Commerical Asbestos Co., Boston, Mass.; asbestos specialties; $10,000. Michael Brachanow is president and treasurer, Revere, Mass.

Illinois Alcohol Co., Columbia Ave. and Locust St., Belvidere, Ill.; industrial alcohol; $350,000. Representative: Alschuler, Putnam & Flannigen, Aurora, Ill.

Southern Paint Co., Monroe, La.; paints, varnishes, etc.; $12,000. Incorporators: C. J. Raley, Ruston, La.; and J. J. Turner, Monroe. The last noted will be secretary and treasurer.

United States Fertilizer Chemical Co., East Orange, N. J., care of S. D. Townsend, Jr., 925 Market St., Wilmington, Del., representative; chemicals, fertilizers and kindred products; $500,000. Incorporators: Theodore Rodman and Joseph J. Quinn, East Orange; and W. Bausch, Hoboken, N. J.

San Antonio Soap & Refining Co., San Antonio, Tex.; soaps, oils, etc.; $100,000. Incorporators: W. M. Foster, E. N. Badger and C. G. Meusebach, San Antonio.

Central Glass Mfg. Co., Oak Park, Chicago, Ill.; glass products; nominal capital $3,000. Incorporators: Albert M. Rechs and Albert J. Fihe. Registered office, 626 Roosevelt Rd., Oak Park.

American Standard Ink Corp., New York, N. Y.; ink products; $20,000. Incorporators: Mrs. J. Carroll and F. J. O'Neill. Representative: W. E. O'Neill, 6828 Narrows Ave., Brooklyn, N. Y.

Reliable Pattern & Casting Co., Cincinnati, O.; metal castings; $20,000. Incorporators: Elmer A. Young, Edward Korten and Arthur Kuhn, all of Cincinnati.

Homer Producing & Refining Co., Mannington, W. Va.; refined petroleum products; $20,000. Incorporators: A. D. Hess, H. E. Martin and Charles W. Barrack, all of Mannington.

Amal Paint Sales Corp., New York, N. Y.; paints, varnishes, etc.; $20,000. Incorporators: J. A. Hughes, W. J. Martin and H. E. Piercy. Representative: H. R. Guggenheimer, 55 Liberty St., New York.

Indiana Hide & Tallow Co., Huntington, Ind.; grease, tallow, oils, etc.; $100,000. Incorporators: Clarence F. Juillerat, John Karst and Emmett Harger, all of Huntington.

Reddy Rubber Co., Akron, O., mechanical and other rubber goods; 500 shares of stock, no par value. Incorporators: Selena L. Keys and Rufus W. Clark, both of Akron.

West Virginia Manganese, Inc., Charleston, W. Va.; manganese, steel products, etc.; $25,000. Incorporators: C. K. Nesbit, Carl Scholz and J. T. Lightner, Citizens' National Bank Bldg., Charleston.

Mysterious Chemical Co., New York, N. Y.; special chemical compounds; $10,000. Incorporators: L. Langman, F. Rosenzweig and C. Cohen. Representative: Barron, Rice & Rockmore, 220 West 42nd St., New York.

Golden Foundry Co., Columbus, Ind.; iron and other metal castings; $35,000. Incorporators: Walter I. Golden and Charles Shipman, both of Columbus.

Record Sales Co., Inc., Fall River, Mass.; shellac, paints, and kindred products; nominal capital $1,000. James E. MacPherson, president; and Edward S. Parks, 291 High St., Fall River, treasurer.

Kleanwell Products Co., Inc., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative; mold and core treating compounds; $105,000.

New Publications

The Fourth Annual Report of the Scientific and Industrial Research Council of Alberta, 1923, has just been published by the Industrial Research Department, University of Alberta, Edmonton, Alta., Canada.

New U. S. Geological Survey Publications: Preliminary Summary, Mineral Resources of the United States in 1923, with an introduction by Frank J. Katz and statistics assembled by Martha B. Clark, published Aug. 6; I: 2, Platinum and Allied Metals in 1923, by James M. Hill (Mineral Resources of the U. S., 1923), published Aug. 9, 1924; II: 3, Magnesium and Its Compounds in 1923, by J. M. Hill and G. F. Loughlin (Mineral Resources of the U. S., 1923), published July 28, 1924.

New Bureau of Standards Publications: Circ. 168, U. S. Government Master Specification for Asphalt for Unsurfaced Built-Up Roofing; Circ. 174, Specification for the Construction of Built-Up Roofing, Type 5ACS; Scien. Paper 490, Spectra and Critical Potentials of Fifth Group Elements, by Arthur E. Ruark, F. L. Mohler, Paul D. Foote and R. L. Chenault; Tech. Paper 259, Saturation Relations in Mixtures of Sucrose, Dextrose and Levulose, by Richard F. Jackson and Clara Gillis Silsbee.